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INFORMATION ON PREPARATION OF PAPERS FOR PRESENTATION TO THE AMERICAN SOCIETY OF CIVIL ENGINEERS

FOREWORD

This digest has been prepared for the purpose of furnishing information to members of the Society about the preparation of papers, the character and type of papers suitable for publication, the kind of publication in which they may be printed, the general rules regarding acceptance of papers, editing, and the like.

It is of prime importance that the publications of the Society be maintained at a high standard of excellence.

Before preparing papers for presentation to the Society, authors should examine the *Proceedings* and *Transactions,* in order to familiarize themselves with the arrangement and style in which papers are published.

PUBLICATIONS OF THE SOCIETY

The publications of the Society are of three kinds—*Proceedings, Transactions,* and Separates.

Proceedings is published monthly, except in June and July.

Transactions is issued one or more times each year and contains only the more important of the papers accepted by the Society, in their final form and with complete discussion.

Separates are casual publications issued by the Society as occasion requires. They include the Year Book, issued annually, and other separate publications of varying character, such as the Manual of Engineering Practice, and the Manual of Definitions Used in Sewerage and Sewage Disposal Practice. They are issued from time to time for the information of the membership.

With the exception of the Year Book all Separates must receive the approval of the Board of Direction of the Society, and, in the case of those originating in Technical Divisions, that of the Executive Committee of the Division involved is also necessary.

GENERAL

Authors.—The privilege of submitting material for publication is not limited to members of the Society, but is extended as well to non-members. Papers and discussions, therefore, may be submitted by any one desiring to do so.

Addressing.—Papers and discussions sent to the Society should be addressed to "The Secretary, American Society of Civil Engineers, 33 West 39th Street, New York, N. Y."

Typing.—Manuscript shall be typewritten on one face of the page only, the lines being double-spaced, with at least 1-in. margins on all sides of the page. Letter paper (8½ by 11 in.) of ordinary thickness shall be used. Blue print or hand written copy is not acceptable.

Number of Copies.—At least an original and two carbon copies of a paper are required. This, however, does not apply to discussions, of which an original is sufficient.

Financial Limitations.—Funds are not available to publish all the papers offered, and many must be omitted for this reason. Others may be published only in *Proceedings*. It may be also necessary to omit much supporting information from some papers accepted for publication. Papers, therefore, should be condensed as much as possible, without omitting matter of decided importance.

PREPARATION OF MANUSCRIPT

Outline.—For his own convenience in the preparation of a paper and to ensure the logical presentation of the material, an author should first prepare an outline of the subject, using appropriate headings for major divisions and sub-divisions, and thus provide a skeleton upon which the detailed treatment of the subject may be based.

Contents.—The principal parts of a paper are:

Title (required)
Synopsis (required)
Main body (required)
Conclusions (required, if pertinent)
Bibliography (optional)
Appendix (optional)

Not all papers will contain all the parts enumerated, but the order in which they are listed is logical as far as it is applicable to any particular paper.

Title.—The title should be brief and should indicate only the general subject treated, without details. Nine words should usually be considered as the maximum length of title. A shorter title is desirable, if possible.

Synopsis.—Each paper must be prefaced by a Synopsis giving a brief digest of its contents and conclusions and a statement of the general scope of the subject intended to be opened for discussion. No fixed rule for the length of the Synopsis is practicable; it should be only sufficient to indicate whether the paper contains such material as to warrant detailed study for a particular purpose.

Body of Paper.—The body of the paper, which is the main discussion, should be constructed upon the author's outline, and should treat the subject logically from premises to conclusions. Main and sub-headings should be used, in order to facilitate ease in reading and reference. The language should be simple and the statements so concise and clear as to admit of no ambiguity to one not a specialist in the subject treated. In general, extended mathematical discussions should be confined to appendices, only the fundamental equations being used in the body of the paper. Mathematical derivations that are not essential to the clear exposition of the main thesis should be omitted.

Conclusions.—If pertinent, the paper should be closed with a statement of the conclusions and an explanation of the relation of the results to present practice, as well as the departure from or improvements on, the preceding state of the art.

Acknowledgments.—Acknowledgment should be made to persons who furnished information or contributed material for the paper, or who were responsible for the work described.

Bibliography.—Extensive sources of information examined in preparing a paper, should be listed as a bibliography. If the sources are not sufficient to warrant a bibliography, references to occasional outside sources may be recorded as footnotes.

Appendices.—Extended mathematical derivations or special detailed material necessary for the adequate presentation of the subject should preferably be grouped in appendices.

Notation.—Symbols defining specific factors in mathematical discussions are to be listed. Authors should use the standard notation of the Society, unless new symbols are introduced, in which case care should be taken not to assign widely different characters to like or similar factors.

Notation representing dimensional equations must state the units in which the terms are used, thus, M = moment, in foot-pounds.

ILLUSTRATIONS

Illustrations, whether drawings or photographs, should be referred to in the text, as figures, bearing suitable titles and numbered consecutively in the order in which they appear.

Illustrations are not to be inserted in the manuscript, but grouped separately, for the convenience of the engravers. Sketches are not to be included on pages containing typed matter unless duplicate sketches are furnished separately.

Drawings and photographs should be chosen with regard to suitable reduction to accommodate the standard type page, 4½ by 7½ in. Folded plates will not be used.

Drawings.—Drawings prepared for illustration need not be elaborate and should show only such information as is essential to the paper. Long equations or explanatory statements are not to be placed on drawings, but incorporated in the text with other general descriptions of the diagram.

Ink drawings on paper or cloth, or pencil sketches, can be used for illustrations. Blue prints are acceptable, if they are clear. Shop or working drawings are unsuitable unless unessential details have been marked out or otherwise designated.

Photographs.—Photographs should be selected for illustrating matters of importance in the paper, and not as attractive pictures. They must be of such character that the information to be conveyed can be suitably brought out in reproduction.

Photographs for reproduction should be in black tones and on glossy paper.

TABLES

Tables.—Typewritten tables are to be inserted in their appropriate places in the body of the manuscript. Blue print tables are not to be used.

GENERAL RULES FOR ACCEPTANCE OR REJECTION OF PAPERS

Acceptable Papers.—Papers to be accepted must have positive value, either because of new and essential facts presented or because they furnish the basis for profitable discussion. The Society reserves the right to reject manuscripts in whole or in part and to edit under the guidance of the Committee on Meetings and Publications. All papers on acceptance become the property of the Society.

Unacceptable Papers.—Papers are not acceptable if they contain matter readily found elsewhere, controvert established facts, advocate special interests, or are purely speculative or foreign to the purposes of the Society.

Papers otherwise acceptable, but carelessly prepared, will also be rejected.

Informal addresses, lantern-slide lectures, and papers describing local projects in a general or semi-popular manner, are not acceptable for publication.

Papers Acceptable for Filing.—Technical papers, results of research, and detailed analytical descriptions of completed works, that are considered to be contributions of permanent value, if accepted for filing by the Committee on Meetings and Publications, will be placed in the Engineering Societies Library, where they will be available for reference. In certain cases, papers may be published by the Society without the detailed supporting data, which will be similarly filed.

Release of Papers.—Papers presented to the Society, or to any of its Technical Divisions, and not accepted for publication within a period of six months after presentation, will be released to the authors upon request, for presentation and publication elsewhere.

Consideration of Papers.—Papers submitted to Technical Divisions are to be reviewed by the Executive Committees of the Divisions and by them transmitted to the Committee on Meetings and Publications. Papers summitted directly to the Society will be referred to the Committee on Meetings and Publications for its consideration.

The Committee, with the advice and assistance of such members as it may call upon, shall pass upon the suitability of each paper for publication.

If accepted for publication, papers shall be first printed in *Proceedings,* unless in the opinion of the Committee on Meetings and Publications they should be issued in some other form.

Papers accepted for and printed in *Proceedings,* together with the discussions thereon, are later to be examined by the Committee on Meetings and Publications in regard to publication in *Transactions.*

Revision of Papers.—If a paper as submitted is not acceptable, but may be made so by revision, it will be returned to the author for such revision.

Publication of Committee Reports.—Unless otherwise ordered, Progress Reports of Technical Committees will appear only in *Proceedings;* Final Reports of such Committees may be published both in *Proceedings* and in *Transactions.*

Preprints.—No paper is to be preprinted for use at a meeting, unless in the opinion of the Committee on Meetings and Publications the subject matter and the discussion thereon are likely to be of sufficient value for later publication in *Proceedings.*

This prohibition does not extend to the issuance of mimeographed copies of a paper for use at a meeting.

EDITING PAPERS FOR PRINTING

For the guidance of authors, a few of the general rules covering the editing of papers for printing, are given. The work of the Editorial Department will be much simplified if authors will bear these rules in mind.

Methods of Expression.—Text, tables, and illustrations are methods of expression, and the same information should not be expressed by more than one of these methods.

Brevity.—Statements are to be condensed as much as possible, and the number of illustrations shall be kept as small as practicable. Extensive quotations are to be deleted, reference being made in a footnote to the quoted article.

To encourage dignified and concise statements, papers and discussions are to be written in the third person.

Accuracy.—Expressions, such as "about 25 years ago", "recently", "in the near future", etc., should be avoided by giving specific dates.

Lengthy descriptions of temporary or transient phases of the subject should also be avoided as they tend to make the paper obsolete by the time it appears in *Transactions.*

Spelling, Abbreviations, etc.—All material printed by the Society is to conform to the typographical style of the Society as regards spelling, abbreviations, conventional signs, hyphenated words, etc.

On questions of spelling and abbreviations not covered by rulings of the Committee on Meetings and Publications the usage of the Standard Dictionary is to be followed.

Lists of the principal abbreviations adopted as standards by the Society, and of the symbols for use in formulas, the latter being those adopted by the American Standards Association, are given as Appendices at the end of this Manual.

Grammar.—Grammatical errors are to be corrected, and involved or poorly constructed sentences to be improved.

Other Editorial Work.—Manuscripts are to be edited by eliminating repetition of information, deleting material readily found elsewhere, and rearranging text, tables, or illustrations as found necessary. Headings and sub-headings are to be provided, if necessary, to improve the appearance and readability; but display headings, expanded type-setting, or italics for emphasis, will not be used. Idioms, colloquial and slang expressions are to be deleted, unless especially pertinent, and if permitted are to be translated for the benefit of persons not familiar with the particular expressions used. Material showing personal prejudices or constituting indirect advertising, will be excluded.

Discussions.—Discussions must relate directly to the subject of the main paper. Comments on a previous paper, or on previous discussion of the paper under consideration, will not be published.

Closures.—Authors' closures are to be confined to the subject-matter of the main paper, and not used as vehicles for introducing new material. Interrogations, rhetorical questions, etc., are to be avoided in closures as they tend to re-open discussion in other papers where the comments are not pertinent.

Authors' Approval.—Manuscripts of papers are to be returned to authors for examination and approval prior to publication.

Corrections.—Readers are urged to advise of errors discovered in papers and discussions, in order that correction may be made for *Transactions.*

APPENDICES

Appendix I.—Abbreviations.
Appendix II.—Mathematical Symbols.
Appendix III.—Hydraulic Symbols.
Appendix IV.—Sample Table.
Appendix V.—Sample Page Showing Method of Writing Footnotes and references.
Appendix VI.—Sample Page Showing Method of Presenting Summarized Data.

APPENDIX I

Abbreviations

Name.	Abbreviation.	Name.	Abbreviation.
Inches	in.	Minutes	min.
Feet	ft.	Hours	spell out
Yards	yd.	Linear	lin.
Miles	spell out	Square	sq.
Pounds	lb.	Cubic	cu.
Grains	spell out	Per	spell out
Tons	spell out	Fahrenheit	Fahr.
Gallons	gal.	Centigrade	cent.
Metres	m.	Per cent	% or per cent.
Millimetres	mm.	Volts	spell out
Centimetres	cm.	Ohms	spell out
Kilometres	km.	Watts	spell out
Kilogrammes	kg.	Kilowatts	kw.
Grammes	spell out	Kilowatt-hour	kw-hr.
Milligrammes	mg.	Watt-hours	watt-hr.
Seconds	sec.	Amperes	spell out

Name.	Abbreviation.
Kilogramme-metres	kg-m.
Metre-kilogrammes	m-kg.
Brake horse power	b. h. p.
Electric horse power	e. h. p.
Indicated horse power	i. h. p.
British thermal units	B. t. u.
Gramme-calories	g-cal.
Kilogramme-calories	kg-cal.
Magnetomotive force	m. m. f.
Electromotive force	e. m. f.
Revolutions per minute	rev. per min.
Circular mils	cir. mils
Miles per hour per second	miles per hr. per sec.
Candle-power	c-p.
Watts per candle-power	watts per c-p.
Mean effective pressure	spell out
High-pressure cylinder	spell out
Diameter	spell out

APPENDIX II

Ordinary Mathematical Symbols

$=$ Equals; is equal to.

$\neq$ Is not equal to.

$+$ Plus, as $3 + 1 = 4$; positive, as $+\frac{1}{25} = +\ 0.04$; extension, as $\frac{1}{3} = 0.33\ +$.

$\times$ Times; multiplied by. (Distinguish from letter x; do not use $a\ .\ b$)

$-$ Minus; negative, as $-\frac{1}{4} = 0.25$; contraction, as $\frac{1}{6} = 0.17-$.

$\overline{+}$ or $\pm$ Plus or minus. Use $= A \pm$ rather than $\backsimeq a$.

$\underline{+}$ or $\mp$ Minus or plus.

$<$ or $\angle$ Is less than.

$>$ or $\angle$ Is greater than.

$\overline{>}$ or $\overline{\angle}$ Is equal to or greater than.

$\overline{<}$ or $\overline{\angle}$ Is equal to or less than.

∞ Infinity, as $\frac{1}{0}$.

$\propto$ Varies directly with, or is proportional to.

$\frac{a}{b}$ Proportion or division. (Do not use a/b or $a:b$.)

$\sqrt{\ }$ Radical sign; square root; as $\sqrt{b} = \sqrt[2]{b} = a^{\frac{1}{2}}$.

$\sqrt[n]{\ }$ nth root. (Be sure to indicate how much of following mathematics is included under radical sign.)

Differentiate between 0 (zero) and o (letter o).

Differentiate between 1 (numeral 1) and l (letter l).

In writing numbers having several digits, half spaces are used instead of commas to separate groups of digits, as 1 000 not 1,000.

When $\log x$ is ambiguous, use $\log_0 x$ or $\log_e x$.

Write degrees, minutes, seconds, as $37°\ 25'\ 10''$.

APPENDIX III

SYMBOLS FOR HYDRAULICS*

ACCELERATION:

a = in general
g = due to gravity
A (or a) = area

CHANNEL FLOW:

A = area of section
V = average velocity in section
d = depth of flow
R = hydraulic radius
S = hydraulic slope
L = length
B = surface width
n = Kutter's coefficient of roughness
m = Bazin's coefficient of roughness
C = Chezy's coefficient

COEFFICIENTS:

c_v = of velocity
c_c = of contraction
c_d = of discharge
n = of roughness, Kutter's
m = of roughness, Bazin's
C = of Chezy
ρ (*Rho*) = density (see Symbols for Turbines and Pumps)
D = diameter
P = energy per unit time (power)
f = friction factor used in expressing pipe loss

HEAD:

h or H = in general
z = elevation head
h_p = pressure head
h_v = velocity head
h = lost head†
R = hydraulic radius
S = hydraulic slope

PRESSURE:

p = intensity of
F = total pressure (force)

PIPES:

V = average velocity in section
D = diameter of
h = head lost in†
R = hydraulic radius
S = hydraulic slope
L = length
P = power (energy per unit time)

PROPERTIES OF WATER:

ρ (*Rho*) = density (see Symbols for Turbines and Pumps)
K = modulus of elasticity

* Proposed standard of American Standards Association. Approved by Sub-Committee, January, 1929.

† With appropriate subscript.

PROPERTIES OF WATER (*Continued*):

Q = rate of discharge or flow
S = slope, hydraulic
t = time

VELOCITY:

V or c = absolute (see Symbols for Turbines and Pumps)
v or w = relative to moving casing (see Symbols for Turbines and Pumps)
u = of moving casing
μ (*Mu*) = absolute
ν (*Nu*) = kinematic (kinematic viscosity = absolute viscosity ÷ density)

WEIGHT:

w = per unit volume (see Symbols for Turbines and Pumps)
W = per unit time

WEIRS:

H or h = head as measured
h_0 = velocity head of approach.
Z = crest height
B = crest length
v_0 = velocity of approach

LIST OF SYMBOLS SPECIALLY RELATED TO HYDRAULIC TURBINES AND PUMPS

(Arranged by letters only)

(*a*) SYMBOLS RELATING TO DIMENSIONS:

B = axial breadth or depth of runner entrance
D = diameter of runner or impeller
D_1 = diameter of runner or impeller vanes at the middle of the entrance space
D_{th} = diameter of runner or impeller throat (inside diameter or band or shroud ring)
r = radius to any point
α (*Alpha*) = angle between the directions of absolute, water velocity, and runner velocity at any point, measured in degrees
β (*Beta*) = angle between relative velocity of the water and the runner velocity at any point, measured in degrees

(*b*) SYMBOLS RELATING TO EFFICIENCY:

e_h = hydraulic efficiency
e_m = mechanical efficiency
e = total or over-all efficiency

(*c*) SYMBOLS RELATING TO HEAD:

H = total head at any point ($H = h_v + h_p + z$)
h_p = pressure head at any point
h_v = velocity head at any point
z = potential head at any point

(*d*) SYMBOLS RELATING TO POWER:

P = power or energy per unit time
P_1 = power of turbine under 1-ft. head
P_b = power at brake
P_w = power from water

NOTE: Where power is to be expressed in horse-power, or other units, statement to that effect should be made in the context

(*e*) SYMBOLS RELATING TO SPEED:

n = revolutions per minute

n_1 = revolutions per minute under 1-ft. head

n_s = specific speed or type characteristic as given by:

$$n_s = \frac{n\sqrt{P}}{H^{\frac{5}{4}}}$$

Definition: Revolutions per minute under 1-ft. head attained by a turbine of 1 h.p. capacity, or,

$$n_s = n_1\sqrt{P_1}$$

ϕ (*Phi*) = ratio of peripheral speed of runner to $\sqrt{2gH}$,

$$\phi = \frac{n_1}{\sqrt{2gH}}$$

(*f*) SYMBOLS RELATING TO VELOCITY:

n = circumferential velocity at a point on a rotating runner or impeller

V or c = absolute velocity of the water at any point in a rotating runner or impeller

NOTE: V is recommended for American practice and urged for international adoption. c is recognized as present international usage

V_m or c_m = meridional component of the absolute velocity of the water (component in a plane containing the axis of rotation of the runner or impeller)

V_u or c_u = circumferential or tangential component of the absolute velocity of the water

v or w = relative velocity of the water with respect to the moving runner or impeller

NOTE: The Hydraulic Committee was divided in its opinion as to which letter would best serve the purpose. Small w is largely favored by turbine and pump designers as it conforms to the German and French practice. It has the disadvantage of being confused with the symbol for density unless foreign practice be further followed by adopting γ (*Gamma*) for density. The small v is favored by those in general hydraulic practice and by those in the teaching profession. Under the circumstances, the Committee recommends v and w as alternates, γ being used for density whenever w is used for relative velocity

NOTE: Subscripts 1 and 2 may be used to refer to the points of entrance and discharge in either a runner or impeller, the assumption being that the water always flows from Point (1) to Point (2)

Thus V_1 and V_2 refer to the absolute velocity of the water at entrance and exit from a runner or impeller

Subscript u is to be used to denote velocity component in the tangential direction. Subscript m is to be used to denote velocity component in a meridional direction. Subscript r is to be used to denote the velocity component in a radial direction

Thus, V_u, V_m, and V_r denote components of the absolute velocity in the three named directions

ω (*Omega*) = angular velocity, measured in radians per second

APPENDIX IV

SAMPLE TABLE

TABLE 20.—AVERAGE STRENGTH PROPERTIES OF MATERIAL IN COLUMNS OF SERIES (*A*) AND (*C*).

Column No.	Shape.	Location of specimen.	Number of Specimens Tested at University of Wisconsin.		Tension, in 1 000 Pounds per Square Inch.					Compression, in 1 000 Pounds per Square Inch.	
					Proportional limit.	Yield Point.		Ultimate Strength.		Proportional limit.	Ultimate strength or yield point.
			Tension.	Compression.		University of Wisconsin.	Mill.*	University of Wisconsin.	Mill.*		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	5 by 3½-in. angle	Toe	4	.....	33.9	38.5	.....	60.0	.....	.....	.....
	5 by 3½-in. angle	Average	6	2	33.5	38.3	37.1	60.1	60.5	34.0	37.9†
	10 by 5/16-in. plate	Edge	2	5	37.8	41.6	.....	63.4	.....	39.0	41.8
	10 by 5/16-in. plate	Average	4	10	37.9	40.8	36.1	63.4	60.1	37.6	39.8
2	10-in. 50-lb. H-column	Toes	2	.....	36.0	37.0	.....	58.8	.....	32.6	36.6
		Flanges	6	.....	33.7	36.1	.....	60.1	.....	32.2	35.7
		Average	7	1	33.7	36.1	39.9	60.0	60.0	25.0	36.5†
3	10-in. 15-lb. channel	Flanges	8	.....	26.6	34.4	.....	62.0	.....	.....	.....
	10-in. 15-lb. channel	Average	10	2	29.4	36.4	36.2	62.4	61.5	22.5	34.8†
	12 by ¼-in. plate	Average	4	8	33.2	35.0	34.0	55.2	56.2	29.6	34.4
3*A*	10-in. 15-lb. channel	Flanges	8	.....	31.2	35.5	.....	57.4	.....	.....	.....
	10-in. 15-lb. channel	Average	10	2	30.5	35.5	36.2	57.3	61.5	25.0	33.4†
	12 by ¼-in. plate	Average	4	8	33.4	36.5	34.7	58.2	57.4	31.0	35.5
4, 5, 6,	10-in. 20-lb. channel	Web and root	18	.....	26.4	32.0	.....	54.0	.....	.....	.....
	10-in. 20-lb. channel	Average	30	5	27.1	32.6	34.6	54.2	56.8	23.0	32.2†
4	2¼ by 3/16-in. angle-bar	.....	.....	.....	.....	.....	37.4	.....	64.1	.....	.....
	¼-in. stay-plate	.....	.....	.....	.....	.....	34.0	.....	56.2	.....	.....
5	2½ by ¼-in. angle-bar	.....	.....	.....	.....	.....	36.8	.....	61.3	.....	.....
	¼-in. stay-plate	.....	.....	.....	.....	.....	34.0	.....	56.2	.....	.....
6	2½ by 5/8-in. angle-bar	.....	.....	.....	.....	.....	35.6	.....	62.4	.....	.....
	3/8-in. stay-plate	.....	.....	.....	.....	.....	36.3	.....	60.4	.....	.....
5*A*	10-in. 20-lb. channel	Web and root	6	.....	30.0	32.3	.....	52.0	.....	.....	.....
	10-in. 20-lb. channel	Average	10	2	30.0	32.6	34.6	52.4	56.8	26.0	32.0†
	2¼ by ¼-in. angle-bar	.....	.....	.....	.....	.....	36.8	.....	61.3	.....	.....
	¼-in. stay-plate	.....	.....	.....	.....	.....	34.7	.....	57.4	.....	.....
5*B*	10-in. 20-lb. channel	Web and root	6	.....	25.3	32.4	.....	53.4	.....	.....	.....
	10 in. 20-lb. channel	Average	10	.....	25.1	32.2	34.6	53.6	56.8	24.5	31.4†
	2¼ by ¼-in. angle-bar	.....	.....	.....	.....	.....	36.8	.....	61.3	.....	.....
	¼-in. stay-plate	.....	.....	.....	.....	.....	34.7	.....	57.4	.....	.....
7	10-in. 20-lb. channel	Web and root	6	.....	27.4	32.7	.....	52.6	.....	.....	.....
	10-in. 20-lb. channel	Average	10	2	28.1	32.9	34.6	52.8	56.8	26.2	33.6†
	12 by ¼-in. plate	Average	4	8	35.6	37.2	34.7	58.8	57.4	31.2	35.1
8	10-in. 20-lb. channel	Web and root	6	.....	28.4	32.2	.....	52.4	.....	.....	.....
	10 in. 20-lb. channel	Average	9	2	27.9	32.4	34.6	52.7	56.8	25.0	33.6†
	12 by ¼-in. plate	Average	4	8	31.8	37.2	34.7	58.3	57.4	31.3	36.0
8*A*	10-in. 20-lb. channel	Root and toe	8	.....	29.1	31.8	.....	52.4	.....	.....	.....
	10-in. 20-lb. channel	Average	10	.....	28.6	32.4	34.6	53.2	56.8	24.8	30.9†
	12 by ¼-in. plate	Average	2	4	34.8	38.7	34.7	62.0	57.4	.....	38.2
9	10-in. 20-lb. channel	Web and root	6	.....	27.8	31.7	.....	51.8	.....	.....	.....
	10-in. 20-lb. channel	Average	10	2	27.9	32.2	34.6	52.2	56.8	25.0	31.4†
	12 by ¼-in. plate	Average	4	8	33.1	36.0	34.7	58.7	57.4	31.6	35.8

* Heat test data. †Ultimate strength of a full-sized prism.

APPENDIX V

Sample Page Showing Method of Writing Footnotes and References

based on pseudo theories or mere notions. Yet the ordinary theory of flexure applies more closely to columns than to beams and, intelligently applied, finds better confirmation in the case of columns than in that of beams. This is due in part to the facts that the ordinary theory of flexure neglects the influence of shear on deformation and shear is more of a factor in beams than in columns. The permanent sets under transverse loads indicated in Column (6) of Table 5* may have been due to the transverse load at the center being almost concentrated on a line. The ordinary theory of flexure, which neglects the influence of shear on deformation, gives no indication, in the cases tabulated, of stresses intense enough to produce permament sets. When the influence of shear is considered, however, it indicates that very high stresses, much higher than those indicated by the ordinary theory, may occur if the transverse load is too highly concentrated.†

Under ideal conditions a centrally loaded column with frictionless hinged ends would be subjected to no shear; but in order that the various fibers constituting the column shall act together, it must have potential resistance to shear. This potential resistance has been neglected in Euler's formula, in consequence of which that formula gives a result which is, theoretically, slightly too great, but only very slightly so for a column with a reasonable cross-section.‡

Section 35,§ advocating "Factor of Safety Method in Column Design", is highly commendable and should receive special consideration. If rational methods of computing the relation between loads and stresses and shears are used, then, actually to obtain, in a column, the factor of safety desired, it must be applied to the critical load and not to the critical stress or shear, the critical load being the load which would produce the critical stress or shear; that is, the stress or shear at or near failure.

Quoting from Section 35:

"* * * the logical process in column design is to select a formula which will as nearly as practicable give values of ultimate strength, or some point which represents the practical ultimate value of the column; then to divide the resulting value of average stress, P/A, by the factor of safety corresponding to that used in other members * * *".

This leaves an open question as to just what point in loading should be considered the critical point to which the factor of safety should be applied. In its First Progress Report the Committee stated‖ that:

"The Society's Special Committee on Steel Columns and Struts made use of what was named by it the 'Useful Limit Point' (U. L. P.)¶ as being of more significance in some respects than the ultimate strength of the column or the

* *Proceedings*, Am. Soc. C. E., February, 1929, Papers and Discussions, p. 372.

† *Transactions*, Am. Soc. C. E., Vol. 89 (1926), p. 1257, Equation (22); see, also, Vol. LXXV (1912), pp. 932-953, for effect of shear on deformation of beams.

‡ *Loc. cit.*, Vol. 89 (1926), p. 1423; see, also, *Engineering News*, February 25, 1909, p. 206.

§ *Proceedings*, Am. Soc. C. E., February, 1929, Papers and Discussions, p. 424.

‖ *Transactions*, Am. Soc. C. E., Vol. 89 (1926), p. 1487.

¶ *Loc. cit.*, Vol. LXXXIII (1919-20), p. 1618.

APPENDIX VI

Sample Page Showing Method of Presenting Summarized Data

Summary of Principal Data Relating to the O'Shaughnessy Dam and Reservoir

For convenience of reference the principal data relating to the dam and reservoir may be summarized, as follows:

Date of construction	1922–25
Total length of dam, in feet	1 750
Length of masonry part of dam, in feet	879
Length of earth approaches, including concrete abutments, in feet	871
Height of spillway above low water in river, in feet	64
Height of dam from rock foundation to crest of spillway, in feet	84
Height of dam from rock foundation to roadway level, in feet	105.25
Height of roadway above spillway, in feet	21.25
Maximum width of dam at base, in feet	110
Width of paved roadway, in feet	17.5
Width of sidewalks, in feet	4
Net length of spillway, in feet	765.7
Maximum flood capacity of spillway, in cubic feet per second	110 000
Depth of water over spillway with maximum flood, in feet	12.5
Total available storage capacity, reservoir full, in gallons	5 341 000 000
Average depth of water, reservoir full, in feet	19.8
Maximum depth of water, at dam, reservoir full, in feet	69
Length of reservoir, in miles	8
Average width of water surface, reservoir full, in feet	855
Area of water surface, reservoir full, in acres	829
Area of land cleared and grubbed, in acres	741
Area of land purchased, in acres	1 156
Total cost of dam and reservoir, exclusive of engineering	$2 220 080

Report of Tellers on First Ballot for Official Nominees

"August 1, 1929.

"To the Secretary,
American Society of Civil Engineers:

"The Tellers appointed to canvass the First Ballot for Official Nominees report as follows:

"Total number of ballots received	1 698
"Deduct:	
Ballots from members in arrears of dues	80
" " non-members	1
" without signature	8
"Total not entitled to vote	89
"Ballots canvassed	1 609

"For Vice-President, Zone I:

Frank E. Winsor	314
Scattering	102
Blank	10
Void	1
Total	427

"For Directors, District 1:
(Two to be elected)

Ole Singstad	240
John R. Slattery	231
Scattering	97
Blank	22
Void	0
Total	*273

"For Director, District 4:

Charles H. Stevens	181
Scattering	11
Blank	0
Void	0
Total	192

"For Vice-President, Zone IV:

Joseph M. Howe	432
David C. Henny	374
Scattering	24
Blank	31
Void	0
Total	861

"For Director, District 11:

Franklin Thomas	186
Scattering	46
Blank	29
Void	0
Total	261

"For Director, District 14:

Wesley W. Horner	77
Don A. MacCrea	42
Scattering	10
Blank	0
Void	0
Total	129

"For Director, District 15:

Allan T. Dusenbury	135
Victor H. Cochrane	48
Scattering	9
Blank	11
Void	0
Total	203

"Respectfully submitted,

"Walter E. Spear, *Chairman,*

"A. Lawrie Kurtz,
James H. Richardson,
Jacob Mechanic,
Charles D. Thomas,
F. B. Marsh,

"J. A. Lenecek,
Charles M. Madden,
D. W. Howes,
J. E. Porter,
"Tellers."

* Number of valid ballots cast, on most of which were two nominations for Director.

Charges and Method of Making Charges For Professional Services

Report of Special Committee

This report was approved by the Board of Direction on July 9, 1929, and ordered printed in *Proceedings* to furnish opportunity for the presentation of written discussion. Such discussion will be referred to the Committee for consideration before the adoption of the Final Report.

I.—GENERAL CONSIDERATIONS

The Problem

The following is an effort to draft the principles which underlie, or should underlie, the determination of the amounts of fees or charges, and the methods of making charges, for professional engineering services. It applies particularly to engineers practicing as consultants and acknowledged, to a greater or less degree, to be skilled and expert by education and by length and character of professional service in the line for which their services are desired by clients.

The term, "Engineer", is used herein to define practicing professional engineers, sometimes termed "Consulting Engineers". They may be considered to represent that class of the profession receiving payment for services rendered in an advisory capacity, or otherwise, not for exclusive services on a fixed salary basis. The duties and functions of the two classes may be similar in all respects, but the basis for fixing, and the methods of computing, charges are essentially different.

In this proposition two parties are involved, the employer (or "Client"), who desires to employ skilled and experienced engineering talent, and the "Engineer", who is assumed to be able to furnish the experience and knowledge necessary to solve any case presented.

Clients may be individuals or private companies employing engineering experience for private enterprises. On the other hand, and very commonly, the Client is a body of public servants comprising public boards or commissions. Oftentimes they are utterly unfamiliar with engineering work or the costs or value of engineering service, and are staggered at the large amount of money necessarily included for such service, as part of the cost of an undertaking. Commonly, these clients (as public commissions), while acting conscientiously, have a limited understanding of the situation and an inadequate knowledge of the money value of experienced service.

A number of elements entering into the question of computation of fees charged for professional service are not comprehended by those clients, or by engineers who lack long experience in these matters. A crystallization of the principles which underlie the determination of charges should be of material help to the profession at large; more particularly, perhaps, to the younger men who have had shorter experience in consulting practice.

Relation to Ethics

It is absolutely essential that any charges, or methods used in making charges, for professional service must be based on strict and faithful compliance with a previously established Code of Ethics. Such Rules of Professional Practice are applicable equally between a practicing Engineer and his Client, and also between the Engineer and all other engineers with whom the services rendered may bring him into professional relations.

Codes of Practice.—The Society has already promulgated an established Code of Ethics which is printed in the Year Book and which has its foundation in the "Golden Rule". It has published a Code of Practice, adopted January 18, 1927, as "Engineering Manual No. 1." Attention is also drawn to the resolution* of the Board of Direction, under date of July 6, 1925, recording its attitude on the subject of "Advertising for Professional Engineering Services", and bearing directly upon the ethical questions of engineering practice herein considered.

These fundamentals to honorable professional practice are, therefore, already established; and, while they may be modified from time to time, they must constitute the foundation of service rendered by any member in a consulting or advisory capacity. Consequently, what is here given is not an exposition of the ethics of the profession, but rather conveys sound advice to engineers and clients as a business proposition, under which the Engineer may honorably compute charges for his services in a manner which may be equitable to both.

The employment of a professional Engineer by a Client must presuppose that the service rendered shall be competent and efficient, and that the knowledge and experience of the Engineer is adequate to the rendition of opinions. Such service, irrespective of the character of the employment, of the basis of compensation, or of the subject studied (whether in the preliminary stages, in construction work, in litigation, or in valuations) must be on one, and only one, foundation—honorable and honest service to the Client, representing the best unbiased opinion and judgment of the Engineer.

Bibliography of Subject

A brief bibliography of publications is appended. Especially valuable is the very complete study by the North Carolina Society of Engineers in January, 1928; particularly because it publishes its Code of Ethics and Practice with its study of charges for services, and recommends the inseparable character of the Codes with the process of computing payments for services.

From this bibliography, it is at once evident that, in recent years, many engineering societies, as well as individual practicing engineers, have been much concerned with charges for professional service, not only in the United States, but elsewhere. The computation of such charges on a basis which must be just, reasonable, and equitable for the services rendered and yet constitute an adequate net return to the Engineer, is oftentimes the most embarrassing experience in the execution of an undertaking. He is entitled to a full and

* *Proceedings*, Am. Soc. C. E., December, 1925, Society Affairs, p. 403.

adequate recompense. Frequently he is called upon to deal with clients who have little appreciation of the long, arduous, and costly period of training of the Engineer, nor of the difficulties of carrying out engineering work. They may have slight regard for the value of good engineering experience in the successful execution of works, and lack understanding of the money value of an Engineer's service as a necessary part of the cost.

Basic Factors

The principles here given are particularly intended to assist the individual Engineer in computing the value of his services, in making proposals for those services, as well as in informing clients, whether individuals or public bodies, as to what is considered by the profession to be just compensation, for design and execution of engineering work; or, on the other hand, for engineering advice or expert service. It is also the aim to strengthen the relations between engineers and their clients.

Engineers Unequal in Ability.—By way of preface, it is assumed that, while all men and all engineers may have been created equal, the service of such engineers to their clients cannot, by any possibility, be considered to be equal. The value of the service of any Engineer as a consultant or expert adviser must obviously be related to his particular education and experience in the special line of work upon which he is consulted by his Client. Further, there may be other actual values in his service due to his reputation in the profession or to his relations with financial or public interests, which may render his services of peculiar value to his Client. These frequently entitle him to greatly increased remuneration above that which can be considered in any scale of recommended fees for services of engineers as a body.

Further, it must be considered axiomatic that remuneration for services rendered must be related to the value of such services to the Client. Obviously, therefore, there must be classification in professional service, depending on reputation, professional standing, education, and experience, as well as on the professional responsibility accepted; all of which must, and actually does, grade those engineers engaged in consulting work, so as to be reflected in their proper and just charges. These same principles are no different from those which hold good in other learned professions, such as Law, Medicine, or Architecture. In commercial affairs, as a matter of fact, buyers of supplies and materials pay according to the quality of the goods purchased.

In the effort to obtain work there are obviously elements of salesmanship involved. These must always be subordinated to the standards of ethics expected of a professional practitioner.

Fixed Salaries.—Further, it is hoped to advise the practicing Engineer, to the end that he may demand and thereafter obtain the highest remuneration commensurate with the value of his services.

In the case of experts engaged on a fixed salary for exclusive services, the basis of computation is simple. It is resolved into either (1) the offer by a Client of a salaried rate of payment to an Engineer, for a limited or unlimited period of time, and the willingness of the Engineer to accept the rate offered; or (2), on the other hand, a rate of payment as a salary asked

by the Engineer for stated services and the readiness of the Client to retain the services offered at the rate asked. In either case there is involved only a mutual understanding between two parties, the buyer and the seller. There is to be considered, however, the case of the Consulting Engineer rendering only part-time service, which may be computed on a basis of payment by the year or by the month instead of by the shorter per diem method. For certain kinds of employment this method may be desirable and applicable.

Competition for Employment.—To the complaint not uncommonly made, that competition for engineering service is ruining the profession, the reply is emphatic—legitimate competition on merit is helpful, but it is the frequent and improper disregard of the principles enunciated in the Code of Ethics which is injurious. The profession cannot be ruined by competition carried on in an ethical manner. It is the business of an Engineer to make clear to a Client the value of his services and to make to a prospective Client a fair proposal, on whatever basis of computation the two parties may desire; but such proposal must presuppose a reasonable net return to the Engineer, corresponding to the value of his services and to the measure of responsibility to be imposed upon him.

No cutting of rates in competition to obtain employment can be considered as legitimate, which results in a net return inadequate to meet the "overhead" and expenses and to yield personal profits corresponding to the standards of living to be expected of an Engineer. Competition by way of reducing charges to meet figures supposed to have been made by other engineers is in contravention of the Code of Ethics and is ruinous to the profession.

The proposal by an Engineer to a Client (who has under consideration plans of a project already prepared by other engineers, regularly engaged) to prepare competitive plans without cost, in the hope that bids may produce a lower construction cost and that the volunteer Engineer may supersede those originally employed, is a gross breach of ethical conduct.

The Society has a Standing Committee on "Professional Conduct" to which any such cases should be referred, under its constitutional procedure.

The employment of an Engineer anticipates the best and most efficient service; consequently, any means by which the Engineer can reduce the costs should be adopted as his professional duty. Should this course result in diminishing his ultimate compensation, he should take credit to himself that his expert service has saved money for his Client.

II.—CONTRACTS FOR SERVICE

Written Instrument Required.—The employment of an Engineer by a Client constitutes in every sense of the word a contract between two parties for personal service. As a general proposition, and on important work, the expression of the terms of the service and the obligations of the Client should be as precise as in any other type of contract.

Quite frequently an Engineer, relying on personal acquaintance or the general reputation of a Client, proceeds to study a problem and incurs expense upon an oral order. Often the terms are not even defined and each party proceeds in dependence upon the honor and sense of fairness of the other. To say the least, this is not a businesslike transaction; it leaves the final situation open to serious disagreement and possible litigation at the completion of the work.

The relations of the Engineer with his Client should invariably be clearly defined by a written instrument before commencement of actual work. Whether this is expressed by an exchange of letters or by a more formal legal agreement is immaterial, so long as all the terms are clearly defined. It should state the parties to the contract, define in general the extent and character of the work to be performed, as well as conditions relating to any time limitations which may be involved. Then should follow the terms and payments for various stages of service, in preliminary study, design, and award of contract during, as well as at the completion of, construction.

If it is contemplated to reserve to either party any right of termination of service, prior to the completion of the undertaking, this should be clearly stated with the conditions under which it may be exercised. Otherwise, the agreement should be stated to continue to completion.

Provisions for Modification.—It is probably within the experience of most engineers, that the larger percentage of problems are greatly modified after the original study, during construction; and that the duration of the work is commonly greatly drawn out, involving materially increased expense on the Engineer both for overhead and for his personal service. Recognizing these elements, some engineers compute fees on a quasi-salaried basis, under which method they are not unduly concerned with the lengthening of the time nor with changes in the project, all of the added cost becoming a burden on the Client, where usually it properly belongs.

If the computation of fees is on a percentage-of-cost basis, the question of increased cost, due to enlarged scope or changes made during construction, is automatically made good to the Engineer; but he may not obtain adequate remuneration on account of the lengthening of the duration of the work. In case a flat fee for services is proposed, the Engineer is penalized in respect both to additions to the work and also to its longer duration, unless specific provision is made in his contract.

The consideration of any proposition for reducing the amount to be paid when work is concluded more expeditiously and with greater economy than originally anticipated involves a very complicated problem the solution of which must rest with the parties involved. Under a percentage-of-cost method

the economies are almost invariably reflected in cheaper cost, involving reduced fees; and under a per diem method the economy is obvious.

It is not infrequent that projects are prosecuted to a more or less advanced stage and are then, for some reason, suspended or abandoned. During that initial period the Engineer may have put into the work a great deal of his own time and expense. It is a measure of wisdom in all such new projects, that the Engineer should scrutinize very carefully the financial status of the Client, and having satisfied himself on that point, should have a definite agreement in case of suspension whereby the Client should pay for his services and expenses on a definitely predetermined basis. Otherwise, no such work should be undertaken except under an adequate "retaining fee" prepaid. Sometimes it may be suitable and proper to agree with the Client in advance upon a sum to be paid in case of possible suspension or abandonment.

Recapitulation of Contract Provisions.—Recapitulating, the following items represent the essential provisions to be stated in any contract for service, whether executed in the precise legal form or by exchange of letters:

(*a*) Date of execution of the agreement.
(*b*) Names and descriptions of the two parties to the agreement with their addresses; and in case of a corporate body, the legal description of the incorporation. If the Client is a commission or public body, state the authority under which it acts.
(*c*) Description in brief but precise language of the work to be executed for which the agreement is drawn.
(*d*) Brief but clear statement of the quantities and limitations of the work to be performed.
(*e*) Statement of the character of the work to be furnished by the Engineer to the Client, as well as the limitations.
(*f*) Statement of the obligations of the Client to the Engineer as affecting the work to be executed.
(*g*) Provision as to the ownership of plans and ideas and as to the copyright, if any is desired.
(*h*) Provisions, if any, as to termination of service at dates before final completion; with a statement as to penalty for such termination to be paid by the Client to the Engineer. In case the project involves engineering studies and uncertain procedure thereafter, provision should be inserted for definite payments in case of the abandonment or indefinite postponement of the project.
(*i*) Guaranties as between both parties, in case any such provisions are desired.
(*j*) Money consideration for the work to be executed, including: Times and methods of payments on account; retaining fees; interim payments, both for personal service and expenses; and final payment in full settlement.
(*k*) Statement of any other consideration in payment for services rendered, other than cash payments.
(*l*) Statement when work is to be commenced and when concluded, in case such provisions and obligations are required.

III.—GENERAL METHODS FOR COMPUTING CHARGES

Frequently consideration of professional employment for a stated work under given conditions of service fits in with the adoption of some method of computation of fees. In the adoption of the particular method of computation, usually there are obvious advantages or disadvantages to either party. The following notes should draw to the attention of the Engineer various reasons for considering a method adaptable to the conditions involved, and likely to work out fairly to both parties.

In the computation of charges for professional service, one of the following methods is usually employed, although modifications of any method, or some other unstated basis of calculation may be used, as especially applicable to a particular case:

1.—Percentage of Cost:

Fee based on a percentage of actual cost of work contemplated or constructed.

(*a*) For complete service inclusive of assistance and overhead.
(*b*) For personal service only.
(*c*) For engineering reports or service only (actual cost with percentage added, plus fee for personal service).

2.—Fixed Lump-Sum Fee:

(*a*) For complete service inclusive of assistance and overhead.
(*b*) For personal service only.
(*c*) For personal or complete service for a limited stated period, with per diem charges added beyond the time limit.

3.—Fees on "Per Diem" Rates:

(*a*) For complete service inclusive of assistance and overhead.
(*b*) For personal service only.
(*c*) For either Class 3 (*a*) or Class 3 (*b*) with an agreement for a minimum guaranteed total payment.

4.—Fees on Hourly Rate:

(*a*) For complete service inclusive of assistance and overhead.
(*b*) For personal service only.
(*c*) For either Class 4 (*a*) or Class 4 (*b*) with an agreement for a minimum total payment.

5.—Salary for Part-Time Service:

Computed to either annual or monthly payments.

6.—Retaining Fee:

A preliminary retaining fee paid in advance plus any one of the previous methods for current service.

7.—Contingent Fee.

The decision as to the acceptable method for computing payments necessitates the consideration of various important items, which have a bearing on any agreement for service. The following comments, therefore, relate to the methods already summarized.

METHOD 1: PERCENTAGE OF COST

For engineering service on work which in all likelihood will lead through the various stages to ultimate construction the usual and most convenient method for computing charges is that of a percentage of the cost of the work, either as estimated by the Engineer, or as involved in the actual final net cost. If the work is to terminate with the design and estimating, or at the award of a contract for construction, or at any earlier stage, this method can only be used by assuming the value of the work to be that of the estimates made by the Engineer; but if it is carried to completion the more precise result is to base payments on actual net cost. If the engagement is for personal service only, undoubtedly the cost of draftsmen, field engineering, and overhead must be included in arriving at "net cost", upon which the Engineer will receive his percentage payments.

Items Included.—The precise pre-determination of what is included in "net cost" is of vital importance in carrying to completion any undertaking free from friction between a Client and his Engineer.

Neither the administrative cost of a commission, if it is public work, or of the corporation, if it is for private account, nor the cost of financing or general accounting should be included; but the expense of field accounting, timekeeping, and inspection in the actual work of construction usually, unless specifically excluded, forms part of the "net cost".

Cost of money, including interest on that used during construction, debt discounts, and banking charges are not included in "net cost" on which the Engineer can compute his fees.

Purchase of real property, legal expenses, and costs not related to the actual work of construction which is directed by the Engineer are not included in "net cost" unless there is a specific provision in the agreement for service. In certain cases involving paving and sewer construction it is sometimes provided to include cost of right of way as part of the net cost on which the Engineer bases his fees. In such cases the agreement must clearly define this inclusion.

Effect of Duration of Work.—The grave difficulty involved in the use of a method for payment based on a rigidly determined percentage of cost is in the facts that there must necessarily be an excessively wide spread in the rates established for different classes of engineering work; that the same rates are not applicable uniformly in various districts; and that the method is not readily adjustable in respect of long or short duration of the work as affected by outside and uncontrollable conditions.

With a precise contract for service, however, the percentage method is probably the fairest and best for both parties. It seldom involves difficulty or dispute. Among the advantages are that whatever changes may be made during the development of the work, the Engineer is receiving compensation for, and the Client is paying only for, what work is actually done. If the work, through no fault of the Engineer, is extended unduly in point of time, it may, or may not, benefit him; but in such measure as delayed work increases the cost, the Engineer will benefit. He takes his chance on the disadvantage

directly due to maintaining his services and overhead over a protracted period. This matter might be covered in his contract for services if so desired.

To either party it may be desirable to provide for termination of services at a date prior to completion. This provision may always be made in a contract for service, by assessing an agreed penal sum payable for such termination, or by a provision for arbitration of disagreements.

Distribution of Payments.—Provision should be agreed upon either for interim payments to the Engineer at time intervals based on the net cost expended; or more usually by establishing a drawing account, which does not exceed the money currently earned, with a final settlement on completion of the work.

In computing "net cost", in the event construction is executed under lump-sum or unit-price contracts, the cost account is not concerned in the value or salvage of the plant. In cases, however, where work is executed on a percentage-of-cost basis, the net cost on which the Engineer should receive his fees would be the final net cost of the finished work to the Client; this usually recognizes the salvage value of the plant and materials left over at completion of the work. If the plant and equipment are owned by the Contractor, the salvage is always reflected in his bid prices.

Where the work of the Engineer is closely allied with that of architects, or other engineers, or manufacturers of machinery, for which the services of the Engineer are not employed, the cost of such other work forms no part of the net cost upon which this Engineer should participate in his fees. On the other hand, should this Engineer be asked to design and construct structures in connection with the work of the architect or manufacturer, he is entitled to his full agreed percentages on the cost. It may sometimes be the case, however, that such joint work is so closely related both to the Architect and the Engineer that a division of the fees on those portions may be desirable by mutual agreement.

Either Class 1 (*a*) or Class 1 (*b*) may be further subdivided by allocation of the total agreed percentage into segregated amounts. These may represent the charges at the different stages of the work—preliminary study, design, working plans, award of contracts, and, at times, actual charge of construction on direct behalf of the Owner.

It should be clearly understood as to whether the charges for assistance are payable at the actual sums disbursed or whether they are surcharged to include the overhead. On this subject there are further comments hereafter. In any case, the charges for assistance and expenses should always be paid by the Client and under no condition by a contractor for the work executed. While the latter course is occasionally adopted, it is most improper. (See page 269.)

The process of developing engineering work involved in the professional practice of the members of the Society is so diverse, that to make any general recommendation as to distribution of payments for work done on a flat percentage-of-cost basis, would be quite impracticable, as the kinds of work and the manner in which they are developed are quite varied. Each individual proposition will suggest to the Engineer equitable arrangements for interim

payments, at the different periods in the development of the particular project and such provisions should be written into the agreement between the parties involved.

Engineering Report Only.—An Engineer is frequently called in by a Client to make a report, not contemplating future construction or without regard to the value of the project. Compensation may be made under any of the stated methods depending largely on the time expended, the value of the report to the Client, and the difficulties and responsibility involved. In any case the Engineer is entitled to collect for all costs for overhead along the lines hereinafter considered and to impose thereon a percentage of the cost of such disbursements in addition to compensation for his own services.

Rates.—For rates recommended for adoption and use under a percentage-of-cost method, compare data in Chapter VI, "Rates", Figs. 1 and 2, and Tables 1, 2, and 3.

METHOD 2: FIXED LUMP-SUM FEE

The method of computation of a "flat fee" for services has at times some advantages, usually to the Client. It is adopted in response to the desire of the Client to know in advance exactly what the engineering service will cost, but it introduces considerable difficulties and unfairness in case of modifications to the original project, or in case, for any reason, the work is protracted over a much longer period than originally contemplated. Under this method a definite time limit on service should always be understood.

Safeguards to Cover Contingencies.—In computation, the Engineer must protect himself on these points, either by a provision in the agreement for modification, in which event the underlying idea of definitely fixing the cost is ended, or by estimating high so as to anticipate those possibilities.

He may simply guess at a sum which he believes to be obtainable and which he hopes may be adequate to cover overhead expense, and personal service. More usually, however, and especially if the work involved is of magnitude, he does not consider he can take those speculative chances. He therefore will estimate roughly the value of the work involved and his probable overhead cost and the reasonable percentage which he considers his services are worth, expended over the probable period of time occupied. He may check this on an estimated per diem basis and balance the sums arrived at by all methods, in the light of how much he thinks the job to be worth; how much the Client will be willing to pay; how much can he afford to take it for; and finally, if there is competition, how much can he cut the figure so as to be below the other man? At times, this method works out satisfactorily, but is of questionable advantage to the Client, in case the work is more costly than anticipated, when there is always the danger of not obtaining the best service.

To meet the condition of undue delay of the work through no fault of the Engineer, but involving him in greatly increased expense, a variant is suggested in the agreement, that is for work beyond a specified period the Engineer is entitled to additional payment based on a stated per diem rate. Further provision should be made for added payments in case the original project is largely expanded in scope. Obviously, the reverse conditions, under which the service is reduced extensively, should be provided for equitably.

The establishment of a "flat fee" method of charges is intended to be applicable to the execution of essentially the same general project as originally contemplated. Means for adjustment should be provided for definite changes from the original project. In any case the conditions governing any proposition under this method should be defined by prior arrangement.

METHOD 3: PER DIEM RATE

The method of computing professional fees on a per diem basis is peculiarly adapted to work involving irregular personal service and is quite generally used. It is equitable, in that payment is made for service actually given. The application of this method varies greatly among different engineers according to employment and locality, which makes it most necessary to have a clear agreement beforehand.

Custom is by no means uniform as to these points. The most usual and serious question involved is in regard to what is meant by a "day" for which a stated per diem payment is earned and paid. For Court proceedings it is strictly correct to charge a full per diem rate for any part of a day in which the Engineer employed as an expert is required to attend in Court, whether or not he may be on the witness stand giving testimony. He is there in attendance at the call of Counsel preparing and trying the case, and at all such times he is available for advice, is qualifying himself to testify, or is watching the case on behalf of Counsel.

Use for Court Work.—The per diem method is that commonly used in Court proceedings. It seems to be assumed by some lawyers or clients that the services of a professional Engineer are of less value during the preparation of a case before trial or in arbitration, than they are when in Court. It is suggested that the Engineer is of equal value in all stages of legal proceedings; and he should charge for his time on the same basis throughout, under whatever method of charges he may have agreed with his Client.

In the preparation of cases in litigation and generally in work done on a per diem basis, it is customary to assume that a full day represents a minimum of 6 hours' actual work (although 8 hours would be charged as one day) and to apportion the work done as full days on the basis of 6 hours. Frequently, it is agreed that work in consultation shall be paid for as a full day for any part of a day in which such service is rendered. This course is both reasonable and equitable, as the mental processes of the Engineer do not begin or terminate with the actual hours of employment. Further, in the service of a Consulting Engineer it is usually knowledge and experience that are being purchased, due to his familiarity with the case or with the principles involved; his advice, therefore, often can be conveyed in a very brief period.

Professional Advice.—Where only personal advice is asked for by the Client, computation on a per diem basis may result in gross injustice to the Engineer. In these cases the result of long experience and profound knowledge in his professional equipment, may be obtained by an unscrupulous Client for an inadequate remuneration. To guard against such misuse of this method of recompense, it is necessary that the Engineer should require a fair minimum total fee to be paid for the service.

An Engineer may be called in as an expert in a lawsuit to give testimony of an important and corroborative character in which his services are limited to a very short period, and do not involve the necessity for preparation of the subject or of the case. The particular knowledge or experience of the

Engineer may be disclosed in one or more hearings, or in testimony of very short duration, without preparatory employment; and the service may thus terminate. Such service may be of great value to the Client and charges cannot be based on the ordinary per diem remuneration at the usual rates. They should be two, three, or more times the normal rates for regular service. The amounts charged should bear relation to the value of the advice or testimony to the Client.

Incidental Expenses.—If traveling is necessary to the employment, the time required should always be considered as regular service and charged accordingly. In case of long-distance transportation a full day is charged at a per diem rate, but a night taken in travel is not counted if it intervenes between two days charged for.

Under this method it is sometimes not clearly defined on what basis payment shall be made for the services of assistant engineers. As a result often the Engineer employed on a per diem rate assumes to himself the right to reduce his assistants' time to the equivalent value of his own fees and includes charges on some arbitrary basis as if the services had been rendered by himself. This is a most unsatisfactory and irregular practice which should not be recognized. The services of assistants necessarily used should be the subject for clear agreement and the corresponding proper charges assigned which include fair recognition of the overhead of the Engineer and his organization and their readiness to serve. This is more honorable, more economical for the Client, and avoids embarrassment to the Engineer, who is thereby not a loser in having to employ assistants for whose service he obtains no compensation.

Minimum Guaranteed Payment.—At times in consulting practice, particularly when the personal service to be rendered is likely to be irregular, it is quite usual for the Client to engage the Engineer on a per diem basis, with a definite guaranty of a minimum aggregate payment either for the complete job or per annum. The per diem rates established will follow the general recommendations already outlined, depending on experience, importance, responsibility, and magnitude of the work. The determination of the upset minimum must depend on mutual negotiation, based on equitable consideration of the probable service to be rendered and the value of that service.

A possible variant from the ordinary method of per diem charges for fees, which may be suitable in some cases, is to arrange for a reasonable annual or monthly salary or a retaining fee, and thereafter to superimpose a low rate of per diem fee for the days actually worked. (See "Method 6: Retaining Fee Method", page 251.)

METHOD 4: HOURLY BASIS

Professional engineers in certain lines of business, usually of lesser magnitude and cost, are faced from time to time with work necessitating personal service at quite frequent intervals, but involving only short duration. In fact, engineers in this class of work may carry on a number of such commissions simultaneously and cannot reasonably apply the full per diem method of computation. To meet this condition, it is entirely equitable to agree on a fee based on hourly service. This enables the computation to be summed together for monthly settlement. With this method, it is entirely in order to demand either a fair retaining fee, in addition to the payments on an hourly basis, or, on the other hand, to require that the aggregate of the fees shall be at least equal to an upset minimum, which would be computed as an amount that the magnitude and duration of the work involved would warrant.

Payment for professional service reduced to an hourly basis, entitles an Engineer to a higher rate than would normally be represented by a full per diem fee for similar work. In these cases the Engineer, without question, should include the time occupied in going to and returning from his office and the work, when computing the hours of employment.

METHOD 5: SALARIED SERVICE

This method of computation is developed as an attempt to avoid the un-Engineer to a higher rate than would normally be represented by a full percentage methods of computation. It places upon the Client all the responsibility for delays or for slow procedure, either in developing a project, working it out, or completing it. Also, in cases of protracted litigation, the entire burden of delays and consequent increased costs is on the Client, whether or not those delays may be his fault.

This method may be reduced to a monthly or yearly remuneration, depending on the magnitude of the undertaking. In any case the computation must be determined by the Engineer as his best judgment of the probable extent of the personal service demanded of him and of his known cost of overhead and expense; these are likely to be computed arbitrarily on his own assumption of per diem or percentage of cost involved. Such a method may be solely for personal service with an agreement as to reimbursement of expense and assistance. The rates chargeable under this method may vary between $200 and $2 000 per month, according to the time and service demanded or the importance of the work.

In case an optional termination of service should be demanded in this method, a penal condition should be provided to correspond.

METHOD 6: RETAINING FEES

The use of a retaining fee as part payment for engineering services is by no means a new plan, but it has not been employed as extensively, nor is it as well understood, as in other professions and countries. It is a method highly recommended for development and use.

The Client, contemplating a project in which he needs an expert Engineer, commonly uses his services extensively and for considerable periods in advising him on the merits of the case. He even goes farther than simply preliminary advice by drawing upon the Engineer for his professional service, which is his only stock in trade, without expecting to pay anything for those services, other than the anticipation of a possible later engagement in competition with other engineers. This is not professional nor is it justice to the parties.

Payment on Account.—The retaining fee demanded should be substantial having in view the probable magnitude of the proposition. It is commonly considered that, assuming the project matures and later is executed, the retaining fee originally paid is absorbed into the general total payments for complete service; but in the event that the project falls through, the retaining fee is an adequate compensation for the reservation of the personal service of the Engineer to provide for readiness to serve, for overhead, as well as for such actual service as may have been given.

The receipt of a retaining fee warrants the fair treatment of the Client as to subsequent charges on as reasonable a basis, under whatever the method of computation used, as the Engineer finds he is warranted in making. The application of a retaining fee as the name implies is essentially a payment at the commencement of a project to reserve the personal professional service; and it is always coupled with a basis of payment for the actual service thereafter rendered as well as for the overhead and expenses.

Instances of Typical Use.—Retaining fees are employed for a variety of reasons. The following are simply examples:

(*a*) A Client may have under consideration a certain project in relation to which the services of some particular Engineer are of considerable importance. At the time he may not be ready to disclose the project, but desires to assure himself of the services of that Engineer when the matter develops. It is then proper, by payment of a retaining fee in advance, to reserve to the Client the anticipated services, disclosing only sufficient information to define the work.

(*b*) Similarly, in case of anticipated litigation or arbitration, it is often of vital importance to a Client to engage by retainer the services of a particular Engineer, so as to preclude the possible engagement by opposing parties. The proper procedure is by payment in advance of a retaining fee.

(*c*) Again, a Client may have under negotiation certain business affairs, contracts, or promotion in which it is necessary to be able to state that, in the event of the business being concluded, he will have already engaged the expert services of a particular Engineer to carry out the work. To this end it is necessary to retain the services of such Engineer by payment of a retaining fee in advance for the privilege of using his name.

(*d*) Again, there are cases, unfortunately rather frequent, when there is considerable doubt on the part of an Engineer, as to the solvency of the Client. Then it is strictly good practice to demand, before giving any advice, a substantial retaining fee to safeguard the Engineer in respect, at any rate, to his early expenses and overhead.

(*e*) The requirement of a retaining fee in respect to anticipated work, is not infrequently made to a client who is believed to be in every way responsible, in order to cover the early expenses and overhead up to the time when it would appear suitable to render bills for such services. In other words, in this case, the use of a retaining fee is by way of assisting the Engineer to finance the work contemplated.

Salary as a Retainer.—A variant in the use of a retaining fee is found occasionally in the method of employing the personal service of an Engineer for advice, where it is desired to retain a specially informed expert for infrequent consultations. Under this method an annual salary, which may be subdivided into monthly payments, is paid as a regular retainer. In addition thereto, payments are made on a predetermined per diem basis, usually amounting to about one-half the normal per diem rate, for each and every day for which the services are actually utilized. This is to all intents and purposes the equivalent of the "per diem" method with a guaranteed minimum. (See "Minimum Guaranteed Payment", page 248.)

The demand for a retaining fee enhances the dignity and standing of the profession in the eyes of a Client, without in the end involving him in any greater cost of service. The payment of a retaining fee further seals the obligations of a contract as between a Client and an Engineer and increases its legal standing as an instrument.

METHOD 7: CONTINGENT FEES

Proper and Improper Uses.—The method of computing recompense for professional service by fees either for cash, or on a speculative consideration of stock or paper, contingent on the benefits accruing from the engineering work, is the most difficult of computation. It is entirely dependent on the faith and gambling instincts of the parties thereto, and brings the Engineer close to the question of what is ethical professional conduct. Little or no advice can be given as to the use of this method; it must be subject for negotiations in detail; it must involve contractual relations which will disclose to the Client the entire attitude of the Engineer; and it must define clearly the basis upon which the contingent fees will be ultimately computed.

Attention is drawn, however, to the impropriety of a Client offering to pay an Engineer a large contingent fee, either in full or in part payment, conditional on a predetermined report to be made by the Engineer rendering recommendations, opinions, or estimates desired by the Client and not based on unbiased consideration. This is utterly unprofessional and unethical.

The contingent fee basis of payment is used to a greater extent in the field of Mining Engineering than in what is recognized as Civil Engineering. In mining enterprises it is not unusual for the Engineer to take his recompense from promoters or financial concerns, contingent on the profitable operation of the properties developed. Occasionally, however, a Civil Engineer employed to design, develop, or construct engineering works, may be asked to accept securities of the promoting company in lieu of cash. This course is usually to relieve the company from the necessity of selling that amount of securities; but for whatever reason, it must be considered simply as a business proposition, subject to most careful study by the Engineer, and entirely extraneous to the subject of charges and fees earned.

Questionable Aspects.—The action of an Engineer proposing to a prospective Client to carry out the preliminary engineering work on a project free of charge, conditioned on his employment in case the project is carried on, must be considered to be improper and unprofessional practice.

A greatly developed modification of the contingent fee method of payment is used frequently by engineering banking corporations in promoting new enterprises. The plan adopted is to make an offer to a prospective Client to execute the entire preliminary engineering work in study, preparation of plans, and report, for either no charge whatever or for a nominal fee, in the expectation of being employed after authorization of the project as contractors for the work. Under such a plan, professional engineering is degraded to a mere negligible incident to a great stake possibly obtainable from the financial returns upon anticipated construction and financing.

The proposition of a contingent fee is at times based upon faith in the successful result of the advice, recommendations, opinions, or estimates of an Engineer. Provided that it is in every way honest, and the judgment of the Engineer is not consciously or unconsciously warped to the possible injury of the Client or the public, the method is both ethical and correct.

OVERHEAD

It may as well be admitted that no rules can predetermine the exact amount of charges nor the precise method for computation for any particular case. A great number of factors are involved, so that only the parties considering the specific case at issue can possibly arrive at a determination, after all the conditions are before them. These comments, then, can only deal with generalities.

Capitalizing Knowledge and Readiness.—In this determination the equation is, on the one side, what is a fair total amount that the Client should pay for the professional experience, responsibility, overhead, and services of an Engineer for a specific work under the particular conditions in which he may be employed; and, on the other side, what is an adequate recompense to the Engineer for his readiness to serve, his experience, and his services, as well as for his expenses and overhead in the locality, and for the standard of living, in which he is practicing.

The Client pays for the breadth of education and professional experience which is at the foundation of the Engineer's knowledge. That wisdom conveyed in reports of small compass may be of great money value to the Client, and entitle the Engineer to large recompense.

Social Status and Office Expense.—It would appear, therefore, that there must be a grading of value of services, or, say, a professional classification, which in a large measure is related to the general social standing and cost of living of the Engineer. It is the duty of every Engineer to conduct his affairs so as to enhance the social standards of himself and of his profession. So far as the great cities are concerned, there is a general similarity in the cost of living and of conducting business. All over the country in the smaller cities, the scale of cost of living is reasonably similar. On the other hand, there is probably a considerable difference in the cost of overhead and operating expenses in cities of the two classes and a still further difference in the smaller towns and country districts. Obviously, the charges for engineering service cannot be the same for two engineers, the one residing, maintaining offices, and employing assistance in the great cities, where it is necessary to be in close relations with clients and engineering and business affairs; and the other practicing in country districts or small towns where the costs are very much less.

This would indicate the desirability of segregating, in any proposition, personal engineering service from overhead and expenses as well as from the item of engineering assistance. In any case the Engineer should carefully estimate the cost of overhead, which must include such elements as office rentals and office expense, automobile hire (whether furnished personally or hired), traveling expenses, idle time of assistants and office force (which represents "readiness to serve"), and reasonable allowance for occasional bad debts, which any Engineer is liable to encounter; as well as for the actual reduction of the net fees obtained, by deduction for income and other taxes chargeable to overhead. A reasonable allowance should also be made to represent the initial study or promotion of a project, during the period when it

may not have been remunerative or on an actual business basis, and when no money was earned for work done.

Taxes and Research.—An Engineer employed by a State or political subdivision thereof, as an officer or employee, is exempt from reduction of his earnings by Federal income tax when his duties are established by law or regulations and not by agreement; whereas the professional Engineer acting as a consultant in a temporary capacity is responsible for payment of income taxes on all fees received from the State and political subdivisions, the same as on income from other sources. This is quite a material burden which must be covered by adequate surcharge included in the account for overhead.*

In these days of frequent and radical changes in the science and practice of engineering work, it is an essential part of the service of a professional Engineer that he shall be well informed at all times and up to date in professional practice. Necessarily, this involves an appreciable expense to him, which can only be reflected in his general overhead.

Further, it is necessary, in the consideration of involved problems, for the Engineer to carry on some measure of scientific research in his own special line. For this the only charges which could be made to the Client, who may be benefited, would be by inclusion in the general bill for "Overhead". All these items are necessary costs incurred by any Engineer carrying on a consulting practice.

Generous Overhead "Covers" Extra Expenses.—In the event of computing charges for personal service, therefore, it is of vital importance to allow adequately in the rates charged, on any basis of computation, for these real costs. If it is required that the per diem or percentage rates shall be inclusive of all these items of overhead, it is of great importance that the Engineer should have an accurate knowledge of what these elements represent, and he would then add to what he considers to be a fair net fee for personal service an amount which will adequately cover the overhead costs.

Cases may be presented for which it may appear that a definite and limited sum is available for the item of "Engineering". Then, it is necessary that the Engineer should estimate all the probable deductible expenses, in order to ascertain whether the resultant balance is adequate compensation to him for his own services over the period of time necessarily occupied and for the professional responsibility which must be accepted.

In cases of this nature, as well as those in which all assistance or overhead has to be included, or those in which a lump-sum fee for inclusive service and overhead is contemplated, it is wise for the Engineer to consider all the various bases of computation and to check one method by the other, so that all factors may be considered in the estimate of future net earnings. There is always the danger that in his anxiety to obtain employment he will ignore or under-estimate actual items of cost (which should be included in overhead) and of assistance. He is also very liable to disregard entirely the element of "readiness to serve" which is an actual and real item of expense. The disregard of such costs naturally will result in the Engineer finding, on completion of the work, that he has been inadequately compensated.

* *Proceedings*, Am. Soc. C. E., March, 1929, Pt. 2.

Amount of Surcharge.—In commercial undertakings the merchant maintains with the greatest care the costs of overhead as a necessary part of the conduct of his business. Even such items as "bad debts" and "losses in merchandising" are charged against profit and loss in arriving at a definite percentage representing overhead cost.

The Engineer must bear in mind that he is absolutely in the same condition and that in his anxiety to get employment, he cannot afford to take chances improperly. If he expects to survive he must recognize these factors, particularly during the years when, with brief experience, he is willing to work for scant remuneration, in the hope of building up a business; and before he reaches the eminence in the profession when he is warranted in charging, and is able to obtain, higher fees; and when, due to that standing and greater experience, he is less likely to experience such losses.

In certain cases the Engineer is compensated for overhead by some direct charge; in other cases, when only his personal service is called for, by a sum added to his fee, which, as computed by him, is adequate to cover those expenses. At times, the remuneration is obtained by a surcharge on the wages of assistants employed on the work. The amount of such surcharge must be considered carefully by the Engineer, but naturally varies considerably. In no case should it be less than 50% added to the actual disbursements for labor, and not uncommonly it is found to be 100 per cent. The usual surcharge rate falls between 67 and 75%, which amount is reasonable, when it is considered that cash is paid in advance for the expenditures, both for labor and for all other expenses, whereas reimbursement may be long delayed.

IV.—SPECIAL CASES

Unfair Competition for Private Work

Escaping Overhead Costs.—Among the difficult problems in the question of charges for professional services, is one which involves a not uncommon grievance on the part of those Consulting Engineers all over the country, who operate at great personal expense private offices with competent and experienced assistance. Upon these practitioners devolves a heavy burden of overhead cost, and necessarily their charges for service, on whatever basis computed, must allow for meeting these costs, by added and higher charges for their own personal service.

In direct competition with these engineers for expert employment, there are two groups of experienced and in every way competent engineers, who have no overhead expense. Further, being under permanent and presumably adequate salaries, they are able to enter into competition for employment at cut rates, the amount of which does not represent the normal value of the services rendered, and is so inadequate that the practicing Engineer could not accept employment and profitably continue in business.

These classes are: (*a*) Professors in engineering schools; and (*b*) salaried officers in civil service, presumed to be devoting themselves exclusively to the public, by whom they are employed. To these particular parties is furnished free of cost practically all the overhead and expense that usually falls upon the Consulting Engineer. The professor may also utilize the personal services of his students, without cost to himself. The earnings received as professional fees by these two classes of engineers are simply added compensation to their normal incomes.

Restraints on Public Officers.—This criticism is not intended to convey the idea that there is any impropriety in such service when called for; but it does draw attention to the necessary requirement that the fees should be in no case lower than would normally be charged by a practicing professional Engineer, in equal consideration for the same employment. The assumption of a right to use public servants and overhead for private use, to the competitive detriment of the professional Engineer, cannot be considered strictly ethical.

On this question the North Carolina Society of Engineers openly states that the engagement in private practice on the part of employees of the State of North Carolina is deemed to be improper. The same opinion is also held by many members of the profession.

Arbitrations

The growing interest in the settlement of disputes in connection with engineering works by formal arbitration in place of litigation in the Courts, and the more general provisions, in contracts for settlement of disagreements by arbitration, have resulted in a great many States enacting legislation to make the results of properly conducted arbitration a legal settlement. In certain States, the Enabling Acts have provided for the amount of fees which shall be paid to an arbitrator for services. The United States Arbitration Act dated February 12, 1925, and the New Jersey Arbitra-

tion Law, Chapter 134, Laws of 1923, make no reference to the payments to be allowed to arbitrators. Further, there is no reference made in the Model Act prepared by The American Arbitration Association in 1928, as to the allowable fee.

On the other hand, the New York Arbitration Law, Chapter 275, Laws of 1920, Section 1454, states as follows:

"Fees and Expenses of Arbitrators

"Unless it is otherwise expressly provided in the submission, the award may require the payment by either party, of Arbitrators' fees not exceeding the fees allowed to a like number of referees in the Supreme Court and also their expenses."

In case the proposed fees are inadequate there is no compulsion on any individual to act as an arbitrator any more than in case of legal proceedings for a lawyer to sit as referee. The usual statutory fee for a referee or master, appointed by the Courts to take testimony and report to the Court, is $10 per hour.

Customary Fees.—In all those cases it is customary for both parties to stipulate that the statutory fees are not binding, and to agree on rates of payment on either a per hour or per day basis, which the parties to the suit will divide equally, as compensation to the arbitrator, referee, or master. The rate for payment of an arbitrator in cases of ordinary importance should never be less than $50 per diem for a day's session, or any part of a day considered as a session, based on an approximate average period of six hours, for all the time expended in studying the case as well as in writing his report.

In cases of greater importance, with large sums of money at stake, the parties to the proceedings will usually agree in advance on the rate of compensation, which may be at $100 to $200, or more, per diem, depending on the experience and standing of the arbitrator.

Where a single arbitrator acts as a judge he is entitled to a higher rate than in cases where three arbitrators are employed; particularly as the selection of a single arbitrator indicates the confidence of both parties in the experience, honesty, and judgment of the individual chosen.

In cases of small importance where the issues are not difficult, and where three arbitrators act together, it is not unusual to pay at a per diem rate of $25. The acceptance of such small fees for any sort of personal service, in these times, is not recommended. The rate enacted is usually understood to represent merely a minimum, which, for the legal prosecution of a case, must be paid for service rendered. The minimum rate acceptable to an Engineer for competent service should be $10 per hour, or $50 per day.

Boards of Arbitration.—The theory of arbitration by three arbitrators sitting together, should imply the consideration of a case by a Court of three unbiased independent judges, ensuring a decision on all points at issue by vote of at least two. However, it has become the practice in the United States to insert in all contracts the usual arbitration clause, and the American Arbitration Society has further promulgated the same doctrine. Each side

of the dispute appoints an *ex-parte* representative to act as an arbitrator, in effect to take charge, as a thoroughly informed counsel, of the presentation of his client's case. In some cases these two so-called arbitrators are empowered to select a third who is the umpire and in reality the sole judge in the case at issue. The better plan, and that recommended, is for the third arbitrator to be selected by an eminent presiding judge of a high Court or by some public officer of integrity and unbiased judgment.

In cases of arbitration by three arbitrators, it is the custom that each of the parties to the issue shall pay the fees of his own representative, dependent on the magnitude of the issues at stake and the difficulties of the arbitration. These are matters for original negotiation each with his Client, but in any case of importance the minimum warrantable fee should be at the rate of $50 per diem. The umpire selected should receive a materially higher rate. The charges are sometimes equally divided between the parties and, at other times, payable by the party losing the case, as may be originally agreed upon in the contract for arbitration.

Appraisals of Properties

Per Diem or Percentage Payments.—From time to time the Engineer is called in by clients to make appraisals on engineering works and valuations of properties. Each such case must be considered on its own merits in respect to charges. As far as practicable the preferable payment should be on a per diem basis. The rates should reflect the magnitude of the undertaking. the standing of the Engineer, and the amount "the traffic will bear" (which latter includes the element of professional competition). In any employment of this character on per diem rates there should be a definite segregation of the rates for the Engineer as well as for all his assistants.

In some cases it may be desired to accept remuneration computed on the principle of a percentage of the value of the properties. This proposition necessitates then a careful estimate by the Engineer of the probable services he will himself render, plus the cost of assistance and overhead expense, as well as of the approximate value of the properties, in order to arrive at an intelligent understanding of an amount he must receive from the job, so that it may be profitable to him. Failing that procedure, he may accept percentage rates which appear to be customary, without knowing whether there will be any profit to him in the work undertaken.

Railroad Valuation Costs.—By way of illustration, it will be of interest to note the cost of the Federal valuation of the railroads of the United States. Up to the end of the calendar year 1927, appraisals of the cost of "reproduction new" had been completed on 1 081 railroads, valued by the carriers at nearly $30 000 000 000. The percentage that the expense to the carrier of making these valuations is to the cost of "reproduction new", is as follows:

(*a*) Based on the estimates of value of the Bureau of Valuation, Interstate Commerce Commission..	0.45%
(*b*) Based on the estimates of value as claimed by the carriers	0.37%

In addition thereto the expense to the Bureau of Valuation, for the preparation of the appraisals of cost of "reproduction new" is as follows:

(*a*) Based on the estimates of value of the Bureau of Valuation 0.13%

(*b*) Based on the estimates of value as claimed by the carriers 0.11%

Combining these amounts as representing the actual complete total cost both to the carrier and to the Bureau of Valuation, the cost of the appraisals of valuation of the properties of 1 081 railroads is:

(*a*) Based on the estimates of value of the Bureau of Valuation 0.58%

(*b*) Based on the estimates of value as claimed by the carriers for their properties 0.48%

The extreme care and study of detail expended in this most difficult valuation, are well known.

Certain States, or local subdivisions of States have legal enactments in relation to appraisals on public properties. In private enterprises the cost of making appraisals of valuation must depend in large measure on the information available for use and on the amount of information necessary to be obtained, as well as on the requirements for the degree of accuracy, and on the difficulties involved in the work.

Reasonable Percentage Rates.—By way of illustration it is stated that for an extensive appraisal of a great public utility property involving many millions of dollars in value, the engineers received an aggregate sum at the rate of 0.03% of the valuation. It is reasonable, however, to expect that for a small property the rate of payment would be somewhat greater than in the case of a very large property.

The suggestion is made, without any specific recommendation, that a commonly accepted fee for preparing an appraisal of engineering properties is, for the first $1 000 000, approximately $3.00 per $1 000, or at the rate of 0.3 per cent. For the appraisal of industrial properties the usual fee varies from $2.50 to $3.00 per $1 000, depending on the size of the property.

The Engineer is sometimes employed as a consultant for the smaller public utilities in matters involving appraisals, or for statistical or special rate cases. The payment on the ordinary percentage rates may be inadequate to represent the labor and expense on the part of the Engineer, whereas the service rendered may be of relatively great value to the Client. In such cases it may be considered equitable to enter into an agreement for remuneration at the normal rates, with a contingent fee or added payment, based on the results to the Client.

The Engineer in Building Construction

It is not uncommon to find that individual architects have been graduated in engineering, and are personally competent to carry out the engineering design and construction of foundations, steel framing, and equipment of buildings. Frequently, also, in the office of leading architects, competent

and experienced engineers are regularly employed for the design and construction of the engineering work.

On the other hand, the greater number of practicing architects have little or no acquaintance with such matters and depend for their necessary engineering work on engineers who specialize in the various lines of building construction.

Unprofessional Conditions.—It appears probable that in no branch of the Engineering Profession are the practices of the Engineer pursued in as unbusinesslike a manner, nor with such constant infractions of the Code of Ethics and Rules of Practice, as in building construction. To carry out such duties at rates which are inadequate to execute full and honest work; to offer to prepare designs of foundations and steel construction or other engineering work at lower prices than other engineers in competition for employment; to accept employment at such low rates that only by "scamping" the work, or by such inadequate plans that the designing work has to be carried out by the manufacturer, can the Engineer show a profit for his services; or to be a party to practices which may penalize the Owner—these are too common. They all involve unethical practices which, in any known case, should be reported to the Committee on Professional Conduct of the Society for action.

Possibly the source of the unprofessional conditions in this line of work may be traced to an economic origin. It may be that engineers employ draftsmen to whom inadequate compensation is paid and that to better the individual conditions those draftsmen may enter directly into competition, to the detriment of the work and the injury of the profession. On the other hand, at times unqualified draftsmen offer their services to architects to prepare steel and foundation plans at extremely low rates. Under such arrangements the architect is responsible and depends on the scrutiny of building departments to check the strength and suitability of the designs. Such cases speak for themselves; the remedies would appear to lie with those practicing in this branch of the profession.

Methods of Computing Fees.—For the design and specification of foundation construction, and for steel framing of buildings, the work will usually be carried out for the architect employed by the Owner, and compensation for engineering work may be, as previously agreed, under one or other of the following methods:

(*A*) Personal service.
(*B*) A lump sum for complete work.
(*C*) At an agreed rate per ton of steel erected.
(*D*) A percentage of cost as later defined.
(*E*) Actual cost of work, plus agreed overhead, plus personal remuneration (profit).

The method of calculation of charges used is that most conveniently lending itself to the conditions of work and service. This is particularly the case in relation to the application of the foregoing methods on building

construction. Certain types of building involve complicated and difficult engineering problems, while others are simple. Certain types are massive in their construction while others contain details of intricacy and very light tonnage.

The experience of the Engineer will guide him in the adoption of the method of computation which will yield the most equitable result; and fair comparison may be made by the experienced specialist, as to the relative economy and practicability of calculations under a percentage of cost, or a tonnage, or other basis of computation.

Duties to Be Included.—Under any one of these methods, it must be clearly understood at the time of accepting employment what is, and what is not, to be included in work. Further it must be considered as unprofessional to accept any employment that does not render the complete measure of engineering service. The Engineer himself must be responsible for the design and adequacy of the works for which he is engaged; he cannot honorably accept from an architect employment carrying divided responsibility. A professional Engineer cannot ethically agree to design and be responsible for engineering work which, due to the inadequacy of his service, unloads on a building department or a fabricating steel contractor the actual designing.

Employment, under either of these methods, should include, not only the direct responsibility for the designs and for the adequacy and strength of all members, to the point of furnishing full information, from which the fabricating contractor can prepare details to correspond with his shop practice; but it must further include the service of the Engineer in checking all shop details to ensure correspondence with specifications for strength, suitability, and adequacy.

As a general standard of practice, the Engineer should also require that in his service be included the complete inspection of field erection, of foundations, steel framing, and other construction designed by him. Thus, his responsibility may extend throughout the entire work to completion. Corresponding charges will be made for such inspection and the work defined by prior agreement.

Looking to the best interests of the Owner, it must be considered as the best practice in building construction that the Engineer, whether engaged by the Architect or by the Owner, should be employed by, and be responsible directly to, the Owner. To this end also, it is recommended that the engagement of an experienced Engineer should include the actual responsibility for the preparation of shop details, as well as for designs, so that the competitive bidding on the fabrication of steel work, should be made on the same finished material and not on entirely dissimilar details and construction.

Unless it is otherwise definitely agreed in accepting employment, the Engineer is not usually responsible for mill or shop inspection of steel fabrication, which can be advantageously executed by specialists. Sometimes the quantities involved are so large as to warrant the organization of a special force for that work.

Fees on Building Construction

(*A*) *Personal Service.*—If the Engineer is called in by the Owner, the Architect or the Engineer engaged on the responsible design of the building, the charges will usually be made on a per diem basis for personal service in advice and consultation. To this will be added a sum for expense and overhead along the same general lines as elsewhere indicated for general engineering work. Otherwise this work may be compensated for by a charge of 0.75% to 3% of the total cost either of the steel work erected or of the foundation built.

(*B*) *Lump Sum for Complete Engineering Work.*—A "lump sum" proposition must of necessity be estimated from intimate acquaintance with the general character, and knowledge of the probable volume and difficulties, of the work involved. It is a method which at times may be used advantageously by those engineers with wide experience in building construction, but which to others may be quite hazardous.

Generally the estimate follows the lines previously indicated for other types of engineering service. It includes all steel framing construction, with reinforced concrete extensively used, and may include also the foundation, design, and construction. When this method is employed, it must carry with it full responsibility on the Engineer for the design and execution of the engineering work, particularly in buildings of reinforced concrete.

(*C*) *Tonnage Method.*—A usual method for assessing charges for steel framed building construction, is on the basis of a stated rate per ton (2 000 lb.) of steel designed and erected. This method includes full professional responsibility for design and strength of members and for checking all shop detail plans submitted by the fabricator. Unless it is agreed in the first instance, the rates seldom include superintendence, supervision, or inspection of the actual erection, all of which work should be within the responsibility of the designing Engineer; and the rate should be increased to cover that added cost.

This method lends itself to wasteful design, particularly with those who have had little experience in the profession and in the detailed study of this class of work. The charges customarily made vary extraordinarily from rates as low as $1 per ton to as high as $4 per ton, or a divergence of 400 per cent. It is believed that the difference in the relative weights and characteristics of different types of buildings cannot account for such variations and that the low figures are inadequate to compensate the Engineer for the honest service required. The high figure probably represents full service on buildings involving considerable intricacy and comparatively light tonnage.

For a reasonably simple type of building of large and heavy tonnage, it may be considered that a rate approximating $2.50 per ton represents fair compensation for complete service.

(*D*) *Percentage of Cost.*—Under this heading there are two definite methods in vogue among practicing engineers. The method most commonly used is to make a charge which is a percentage of the cost of the steel work in place or of the combined foundation and steel frame work in place. The other is to base the charges, as a percentage rate, on the total cost of the finished building,

in which case the Engineer is responsible for strengths and design of floors and all other engineering work.

First Method.—There may be considerable range in the proper charges, depending on the type and detail, as well as on the magnitude of the building, and on the adequacy of the information received from the Architect. For a normal large steel framed building of the office or store type, the charge should approximate a rate of 2½% of the cost of the work designed by the Engineer, exclusive of supervision of construction. The normal charges will vary between 2% and 6½%, according to the current cost per ton and the weight of the material, and to the degree of work involved in detailed design. For light weight steel design, difficult truss construction, etc., the proper charge may approximate 4%, while for alterations to buildings involving difficult detailing and engineering problems, the proper charge may vary between 6% and 10% of the cost of the work.

Compensation to the Engineer for alterations to structures may also be computed at three times the estimated or actual cost of salaries of designing engineers and draftsmen engaged for such work. On ordinary foundation work, where no further service is rendered by the Engineer, a fee of between 2% and 4% of the cost of the foundation, depending on the probable cost and type, is reasonable.

For rates under percentage-of-cost method, see Tables 2 and 3.

Second Method.—Using the second method, which is to charge a percentage on the total cost of the building, the following rates may be considered as customary:

(*a*) For office and loft buildings about 0.5% of the total cost of the building with allowable variation based on the simplicity or difficulty of the job.

(*b*) For theatre, auditorium, or other such work involving greater engineering difficulties in the design, the fees to be charged would be higher, or about 1½% or more of the total cost.

Under none of the foregoing methods, do the charges named include the expense for superintendence, for mill and shop inspection of steel, or for the inspection during or after erection. For these items added charges should be made.

For shop and mill inspection, on the smaller sized jobs, it is usual to charge from $2 to $3 per hour plus traveling expenses, for such hours as the inspector is personally employed on the job. For buildings with large tonnage, in which the steel may exceed $200 000 in value, the charges are usually computed on an inclusive rate, approximately 75 cents per net ton of steel fabricated. This represents about 25 cents per ton for the mill inspection and 50 cents per ton for the shop fabrication. For small tonnage, say, costing less than $50 000, the usual rates per ton would be approximately: Mill, 40 cents; shop, 60 cents; total, $1.00.

Inspection of fabrication of heavy bridge work involves greater service and, consequently, requires a higher rate for mill and shop inspection than for building construction steel work. The normal rate on this class of work is $1.00 per net ton.

The charges for inspection during erection include the salary of a competent Engineer Inspector (about $300 per month) and running expenses; or if charges are based on tonnage, the rates would range between 50 and 65 cents per ton of fabricated steel, according to the magnitude of the work.

Should the complete inspection in mills, shops, and field be included in the contract with the Engineer, it is in order to make a reduction from the aggregate of the unit costs itemized, by an amount of from 10 to 20% according to the magnitude of the work.

(*E*) *Cost-Plus Basis.*—The cost-plus basis of charge is for the most part one of bookkeeping. On building construction this method is very satisfactory where all parties included in the business transaction hold the confidence of each other.

The charge is computed by adding together the cost of the time of principals and of assistants, overhead expenses, and remuneration. In drawing up an agreement based on this method, it would be essential to state the unit charges, as well as the rates for personal remuneration of principals, which will go to make up the whole.

The accounting under this method would follow the lines discussed elsewhere for general engineering service. The added percentage charged on payrolls for overhead should be between 75 and 100 per cent. This method is particularly applicable in the preliminary stages of a project that is not definitely determined.

Consistent Costs.—The five methods for charges as described, giving the various prevailing practices as used in the Structural Engineering Profession, indicate generally how the accounting and other records are kept.

The fabricated steel industry, in its relation to building construction, is so stabilized, and the fluctuations in price and the relations of steel tonnage to the various types of buildings are so well understood, that the experienced engineer finds little difficulty in converting rates on any one of the foregoing methods into equivalent rates under any other method. The method adopted is one of convenience in accounting. Further, however widely these methods in deducing the proper final charges may differ, they should produce close results, whichever one is followed.

Generally, the cost of engineering service in building design and construction, will be similar in practically all the larger cities of the United States, where for the most part such buildings are constructed. For buildings erected elsewhere, it is usual to employ engineers in the cities to prepare plans, so that the general scale of charges may be considered to be applicable throughout the country.

The rather common practice, by which contractors for fabricated steel undertake, by their own engineering force to the exclusion of the Engineer, to design the steel framing and foundations of a building, free of charge to the Architect, must be considered reprehensible, besides opening wide the serious question of the honesty of all parties involved. It cannot be overlooked that such preparation of plans must be charged to the cost of fabrication by the Contractor, while the Architect has work executed free of charge for which he

himself is responsible and is to receive payment. Under such an agreement, by the exclusion of any Engineer, there is no experienced check on the quantities or suitability of the designs, and the interests of the Owner are quite unprotected.

Effect of Changes.—Sometimes, after the Engineer has completed or partly completed plans and specifications for a building project as agreed, the Owner or Architect, or both, may change the character of the construction, so that the work already executed by the Engineer is rendered valueless. The adjustment of charges in such cases requires fair consideration by both parties. When a project involving work on structural steel design is abandoned or completely changed, then adjustment between the Owner and Engineer should be made on the basis of three times the cost of the preparation of the work, which includes a profit to the Engineer. If the work originally agreed upon was completed in full, unquestionably the Engineer is entitled to full payment and the new work is subject to a new agreement. More often, however, such service has been only partly rendered, in which case the adjustment should naturally be along the lines of payment of actual cost (with a fair surcharge for overhead and profit) for such work as is discarded, added to the original charges as agreed.

Should the work as finally executed exceed in quantity or in difficulty (and, consequently, in cost) that originally contemplated, further adjustment must be made, on equitable lines, in case the terms of the original contract are not adapted to adjusting such alterations.

Foundation Engineering.—Often the Engineer is called in to design the foundations for buildings. These may be of simple character, involving gravity or reinforced walls for the retention of top soil, as well as footings for columns. Such work may or may not necessitate borings for disclosing the nature of the soil. The Engineer, however, must interpret the natural soil conditions and design safe structures, which shall be in accordance not only with local building codes, but also with the best practices of engineering, and at the lowest cost for the required result.

In cases of steel framed buildings, involving the simpler types of foundations, it is usual for the Engineer to include in his service the preparation of plans for the grillages and retaining walls forming the building foundations. Frequently the cost of this service is reflected in the charges made for the steel design, without specific extra charge being made, but if such is the case the proper allowance should be made in assessing the charges for the steel framing, and it must be clearly provided whether the Owner, the Architect, or the Engineer is to be responsible for obtaining and guaranteeing the necessary information as to the bearing power of the underlying soil.

Should the required foundations be extensive and require detailed plans or the design of underpinning of adjacent properties, a specific charge, covered by an agreement for the service, should be made, separated entirely from the design of the steel frame. The normal fee for this should vary according to the difficulties and magnitude of the work, being about 3½% of the cost, including excavation. It assumes general inspection of the construction.

For many large buildings, however, the necessity for great cellar space or the inadequate bearing power of the upper soil requires the use of special foundations, either spread footings, sheet-piling, coffer-dams, or pneumatic caissons. This construction is a specialized engineering work, with which few architects are familiar, and is usually for buildings of great value, for which the foundations represent a very large cost. This work also usually involves difficult problems of underpinning adjacent structures, as well as methods of shoring during construction, for which detailed plans must be prepared. The charges for such professional service will be estimated as for other engineering work, and by any one of the methods of calculation previously described.

Fees for Subsurface Work.—Such work necessitates expert inspection and supervision throughout the construction period, and unforeseen difficulties frequently arise requiring expert advice. It should preferably be under an agreement executed with the Owner, placing the responsibility with the Engineer. A usual fee for such service is from 3 to 4% of the actual total cost, when based on the "percentage-of-cost" method of computation.

The higher rate is applicable in cases of engineering difficulty, particularly where problems of bracing, shoring, and underpinning are involved. Then, the fee includes service of the Engineer and his expert assistants in general supervision of construction from start to finish; but it does not include, unless specifically agreed, the detailed daily inspection of work, which should be paid for at actual cost by the Owner. The rate named, however, must be predicated on the cost of the work, including all excavation below the original surface of the site on which the building is constructed; otherwise, the rate must be greatly increased.

Relations with Architect and Owner.—In ordinary types of building construction, the services of the Engineer are called in by the Architect employed by an Owner, after the general type of the building has been agreed upon between the Architect and the Owner. On the other hand, in building problems of the greatest magnitude, where the Owner may suspect the possibilities of great foundation difficulties, occasionally the Engineer may be engaged before the Architect is employed, in order to advise on those problems. In such cases the application of a retaining fee with agreement for future employment, should the work proceed to the point of design and construction, would appear to represent the simplest method for charges. There is, in this character of work, no impropriety in the Engineer rendering service direct to the Architect, but he must have complete freedom and be prepared to accept full responsibility for the adequacy and suitability of his designs, always provided the work is carried out in accordance with his specifications.

In cases where the Engineer is employed directly by the Owner and takes the responsibility for letting contracts for the steel work in the foundation, as well as for supervising and inspecting construction, the fees indicated should be correspondingly increased.

It is, however, essential that the conditions of service should be defined in a form of contract, preferably directly with the Owner, as to the extent and

character of the service to be rendered, the basis for payments, and the times when, and manner in which, the charges are to be paid. In any case payment in full should be due immediately on completion of the work designed by the Engineer. It cannot be considered as dependent on the time of final payments made by the Owner to the Architect. The Engineer's service and charges are definitely part of the cost of construction, and his final certificate of adequacy and completion should be furnished to the Owner.

For further detailed elaboration of the subject of the relations of the Engineer to the work of building construction, reference is made to the publication* of the Structural Engineers Society of New York.

Relations of Engineer and Contractor in Structural and Bridge Steel Design

Occasionally an Engineer, and more frequently an Architect, in order to avoid the maintenance of a staff of experienced steel designers, enters into negotiations with a steel fabricating organization to prepare detailed design plans, which are to be submitted to him either for checking and approval, or else to be embodied as representing his own work for which he is employed by his Client. Such designs executed by the Contractor must obviously be paid for by some charge in the bid price, and it would hardly be so undertaken by the Contractor without the prior prospect of obtaining an advantage in the awarding of contracts. It may happen that designs made by a steel contractor might, by conformity with shop standards, create a legitimate advantage in preparing a low bid, but such practice is so clearly open to possible abuse, and is liable to affect so seriously the unbiased judgment of the Engineer acting on behalf of a Client, that it must be considered unethical.

Any competent and reputable Engineer carrying on structural and bridge steel design invariably prepares his drawings so as to conform to shop standards and there should be no advantage in the preparation of plans by the steel contractor that the experienced Engineer cannot himself provide.

At times, a General Contractor is employed by an Owner for construction of a building complete. This Contractor engages the services of an Engineer to prepare plans for foundations with or without steel superstructure and generally to work out the engineering problems involved. Such service is in every way regular and should be compensated as for any other client under one of the various recommended methods of computation of fees.

The Architect in Bridge Design

Another case involving relations between the Engineer and the Architect is represented in relation to purely engineering structures, such as bridges. There the Engineer must be directly and solely responsible for the security as well as for the suitability of the structure; and the Architect can only possibly fill the subordinate function of assisting in the artistic treatment of the design. The work of the Architect must be subordinated to that of the

* Constitution, By-Laws, Code of Practice and Charges. This pamphlet can be secured by application to the Secretary of the Society, H. H. Snyder, 183 Madison Ave., New York, N. Y.

Engineer, although practically they should and will work together to effect a harmonious and satisfactory result. Should the Architect be employed directly by the Owner, it must be a requirement on the part of the Engineer that such employment shall not interfere in any way with either the development or the design of the structures called for by the Engineer.

As a matter of fact, no structure can be considered satisfactory as an engineering design, which at the same time does not meet the requirements for a proper artistic treatment.

Public Service and Governmental Employment

It is expected that every Engineer in consulting practice will patriotically and freely render his best efforts in the public service; further that he will give of his knowledge and experience to the advisory work of Chambers of Commerce, and to other such bodies altruistically doing work for the promotion of the public welfare, without anticipating any direct personal benefit.

There exists, however, no reason why engineers, any more than practitioners in other professions, should engage in engineering work for cities or States, either by departments or by commissions, or for work under departments of the Federal Government, without adequate renumeration equal in all ways to the corresponding charges which would be made for work of the same magnitude, character, and responsibility for private interests. Cities are nothing but corporate bodies, and the States and Federal Government are bodies acting either by departments or commissions for the people. There is no more reason to expect of any such bodies that professional service could be rendered for inadequate recompense, than that political appointees would carry on their employment under the Government without compensation representative of their own individual capabilities.

Within recent years all these governmental subdivisions have entered very largely into the field of commercial undertakings on behalf of the public. Common justice to the profession requires that the rates to engineers employed as consultants should not be less than the same engineers would receive in commercial work carried on under private or corporate administration. With the enormously increased cost of living and practicing his profession, the Engineer must expect to receive from public bodies, a much larger rate of pay than was considered adequate in the years before the World War.

The Contractor Furnishing Field Engineering

In the execution of construction and for its competent administration and honest inspection, the Engineer, who is responsible for the final results, must obviously himself have responsible charge and control of all members of the staff directing the work, measuring quantities, and preparing estimates, as well as of those engaged in the actual inspection of all construction under contract.

This is essentially the engineering work of the job. It is not to be confused with that of the personnel of the engineering force employed by the Contractor in laying out and administering the work of actual construction. The two groups co-operate without conflict of duties or interests.

In certain sections, apparently for political or financial expediency, a custom has developed whereby the cost to the Owner of engineering and inspection services on public works under contract is required to be included by the Contractor in his bid price. The cost of such services is assumed to be a certain percentage of the cost of the work and the Contractor adds the corresponding amounts to his unit prices or to his lump-sum bid. The sum added to cover engineering is paid by the Contractor to the Owner on or before the completion of the work.

The legality of this practice has been upheld up by the Courts in a test case involving a public bond issue. The legality of the procedure does not make it the less reprehensible, as it places the engineers and inspectors in the position of receiving their compensation from or through the Contractor and enables the Contractor to state that he does in fact assume their compensation and payment. This may well result in improper influences being brought to bear on the Owner's representatives to the detriment of the construction work itself. For this, and other obvious reasons, the custom is condemned as improper and undesirable. (See page 244.)

V.—RELATED SUBJECTS

Competitions for Prizes

The subject of competition for prizes is closely akin to that of contingent fees. It is an element of salesmanship and should be approached by the Engineer with great caution. The practice is usual in the case of architects, in whose profession the principles of ethics seem to be better developed than with engineers. Except in competitions for large bridges, the work of the Engineer does not usually lend itself as readily to prize designs as do plans for public buildings.

As to the Client, the main purpose of these competitions is to introduce competitive conditions whereby for a trifling outlay he can have the advantage of a number of pictures, estimates, and reports, which may or may not be of commensurate value. To the Engineer the competition is commonly to bring his name before the public and to obtain advertising of an ethical nature, having to him material sales value, at the cost of his time and a reasonable amount of overhead. To him, the one question is naturally "is the game worth the candle?"

Little or no advice can be given on this subject, but the attention of the young Engineer is called particularly to the necessity for his ascertaining in the first place the financial standing and honorable character of the Client, and the general prospects of the enterprise. Subject to those considerations, it is a matter for the Engineer himself to determine whether the professional publicity to be obtained and the chance of a future stake are adequate to warrant the work he undertakes for the possible acquisition of a prize. In any case it is recommended that plans or designs thus submitted be "copyrighted" before submission.

Ownership of Designs

A question upon which opinions differ widely, but which merits the serious consideration of professional engineers, is that of the ownership of plans for an engineering development. Most frequently this question does not even present itself, but at times problems are to be solved which warrant not only its consideration, but also the inclusion in a contract for service of definite provision thereon.

It is well known that every architect owns the plans he prepares for a building and does not hesitate to take proceedings, in the possible event of such plans being used for duplicating that building. Certain engineering organizations systematically cover by "copyright" all plans, sketches, and designs prepared by them, in order to protect themselves in possible cases of piracy of their ideas.

When this course would appear to be of importance, it is recommended that, in submitting novel designs or plans solving difficult problems in construction, the Engineer should protect them by copyright. He should further require the recognition of ownership by a proper provision in the contract for service.

Continuing Employment

The employment of an Engineer to design and construct usually terminates with placing the works in operation; and the fees are usually co-

terminous with the completion of the work. In certain works, however, it is desirable to extend the professional connection of the Engineer beyond the completion of construction and into the period of operation, either for a limited or for an indeterminate time. The original employment usually carries with it, without other charge than that agreed, the rectification of errors and defects, or improvement of details which may have developed in initial operation. With this service, however, the original employment terminates.

The further engagement of the Engineer is usually of importance to those responsible for operating and maintaining the works. No recommendations can be made as to the charges for such employment as no two cases can possibly be similar. It is usual that such service should be paid for on an annual salary basis, the amount depending on the duties required, the responsibilities to be assumed, and the value to the Client. Usually, such an agreement will define that the service is limited to personal advice and does not extend to new and enlarged projects which should be subject to other contracts.

Bad Debts

It is unfortunate that no profession, any more than any commercial business, is free from the occasional experiences of inability to collect money. In other words, it suffers from what are commonly called "bad debts".

In the anxiety to obtain business, there is often a lack of care on the part of professional men to investigate, in advance, the financial standing or honorable character of a prospective Client, who may offer what on the surface may appear to be profitable employment. The fault is most frequently that of the Engineer and results at times in the question of, "What to do about it?" Should the Client be insolvent, the answer is simple, and the quicker the indebtedness is written off the books and the Engineer pockets his loss to save further worry, the better.

Procedure with Clients Who Could Pay.—The real problem is in cases where the Client could pay if he would. The merchant or business man usually puts the matter in the hands of a lawyer, a specialist in the collection of debts, who first endeavors to apply methods of polite and gentle persuasion, before proceeding to Court action. There is nothing unethical in the same process applied to a professional man collecting a legitimate debt, always assuming that he has adequate proof to offer of the legal liability for the debt incurred. Usually, however, the professional man does not desire to undertake the personal unpleasantness and nuisance of Court proceedings. He would prefer, especially if the sum involved is not great, to forget the debt rather than to prosecute. Further, at times the Engineer has a fond hope that ultimately he may be able to collect, or that there may be other employment forthcoming which will benefit him; in both anticipations he is usually disappointed.

It is recommended in these cases, that the Engineer owes it not only to himself, but also to the profession at large, to enforce payment of debts for service rendered, through the Courts, failing amicable adjustment. There

need be no compunction on his part, nor any consideration for a Client who does not pay a legitimate debt for professional service, as it is certain that no future value, or source of other and profitable work, will be forthcoming from any such person. The only stock in trade of an Engineer is his knowledge of his special line of professional work, and his experience therein, and that stock in trade should be protected in every way as well as he would safeguard goods and merchandise.

The professional man requires of his Client honorable conduct to the same degree as he himself is under obligation to render honest dealing to his Client. Undoubtedly, the annoying experience of bad debts in professional business relations would be reduced materially, if it became universal practice to require contracts to be executed before engineering service was begun.

Cost of Engineering in Public Work

If it were practicable to arrive at figures representing engineering cost, it might be considered that a fee to a Consulting Engineer would be fair which was no greater than the actual cost for the Client himself to carry out the complete work; always assuming that equally efficient and satisfactory service is given. This would presuppose that the Client was able to organize and direct engineering work and to hire competent talent on adequate salaries to do to the fullest extent the things which would be expected of the Consulting Engineer acting in the capacity of a contractor for engineering service. Under such a plan the Engineer Contractor would make his adequate recompense from his assumed greater knowledge of executing the work, effecting thereby greater economies.

There are numerous examples, known probably to all members, of the actual recorded costs of engineering in public works executed under State or City adminstration, as well as great and small undertakings executed under commissions and other public bodies. Furthermore, such figures are at times available to individual members disclosing the costs in private enterprises of the item of engineering; these usually include various items of rentals and expense that probably do not occur in data obtainable for public work.

Usual Fees.—In estimating on projects, both for public and private work, it is usual in these days to allow for the full cost of engineering, including all elements of investigation, research, inspection, and field work, the sum of 10% of the net cost of the construction.

As a practical proposition it is found that the actual complete cost for engineering, with the contributory expenses for either public or private work, is rarely less than approximately 7½% of the cost; while for undertakings which involve a measure of research and allied, although not direct, expenses chargeable to engineering, the estimated allowable rate of 10% on net cost is by no means unusual and, in fact, is frequently exceeded.

In certain States, legal limitations placed upon engineering cost on public works, create a grave possibility of juggling accounts, in order to comply with the law.

The greatest element of difficulty is always to establish any common basis of comparison between percentages of cost for engineering in different

classes of work and for different jobs, on account of lack of knowledge of what are included or excluded as items of cost in the several cases.

Illustrative Cases

Variable Conditions.—The Engineer in negotiating with a Client for employment under a percentage-of-cost method of payment, desires at times to be reinforced with general information as to the actual cost of engineering as related to construction cost on other works, whether of a public or private character. Such figures are obtainable, but invariably must be used with great caution, unless all the conditions involved are thoroughly known, and comparisons are made strictly on the same basis of what is, or is not, included. Obviously, two pieces of monumental work, one compact and localized with a concentrated force and the other spread out over great territory with diversified work and scattered forces, cannot be properly compared.

Further, some engineering works necessitate long and extended study and preliminary investigation, or costly research work; and some involve mechanical and electrical equipment of complex character, while others have no such unusual expense superimposed.

For general information, and for any use to which it may be applied, but without guaranty that the figures are correct, the following examples are cited in relation to works of magnitude. Usually it may be considered that the smaller the work the higher the cost of engineering is likely to be, but that does not always hold good.

The great range in the rates computed for different undertakings must indicate that in all probability the same service is not rendered, or that the same charges are not made, in the various cases.

Stated Cases.—

(*a*) Particular reference is made to the extended information as to percentage cost of engineering on numerous public works, as given in the Final Report of the Special Committee on Valuation of Public Utilities.* Important advice on this subject will also be found in the text of the same report, particularly as indicating the great variation in rates on different works.

(*b*) The Board of Water Supply of the City of New York gives† information as to total construction and engineering costs for the long period between 1905 and 1927, inclusive. In addition to the engineering on the actual construction, this work includes extended studies and investigation for future sources of supply. So far as can be excerpted the disbursements for construction during that period, excluding administration, policing, cost of money, land, taxes, maintenance of completed work, etc., amounted to approximately $135 769 000, on which the engineering charges aggregated $20 230 500. The resultant rate is 14.9 per cent.

(*c*) The Port of New York Authority shows‡ the complete cost of construction of two great bridges between New Jersey and Staten Island, New York, to amount to $12 672 000, upon which the distributed engineering

* *Transactions*, Am. Soc. C. E., Vol. LXXXI (1917), pp. 1311–1620.

† Rept., Board of Water Supply of City of New York, 1927, Table No. 3.

‡ Annual Rept., Port of New York Authority, 1928.

charges amounted to $864 000, or at the rate of 6.82 per cent. The period covering design and construction was about four years.

(*d*) The final statement of construction of the Moffat Tunnel by the Moffat Tunnel Commission of Colorado, shows a net total cost of construction of $11 770 000, for which the engineering expenses aggregate $463 000, or at the rate of 3.93 per cent. The period for design and construction was about five and one-half years.

(*e*) The firm of Fuller and McClintock concluded a contract in 1928 for $605 000 for engineering services on sewage treatment and disposal works for New York City which probably will cost $18 500 000 to $20 000 000.* The contract provides for plans, estimates, specifications, and contract forms, including the services of specialist consultants. The resultant rate is between 3.27 and 3.02%, according to actual ultimate cost.

(*f*) Robinson and Steinman, of New York City, receive a flat fee of $145 000 which covers all services in connection with the erection of a bridge and approaches, at Portland, Ore., also patents on any items of equipment needed for the erection of the bridge.† The cost of the bridge is about $3 500 000 so that the rate is approximately 4.1 per cent.

(*g*) Reliable information received from the City of St. Louis, Mo., as to the percentage cost of engineering as related to the actual cost of construction work for the City, extending over 10 years, 1918 to 1928, gives the following results:

On sewer construction	7.07%
On paving construction	6.93%

During the 5-year period, 1918 to 1923, the rates were higher than the mean of the longer period, or on sewers, 9.77%, and on paving, 9.90 per cent. During a normal 2-year period, 1925 to 1927, the rates were materially lower, or, on sewers, 5.44%, and on paving, 5.26 per cent.

The information received, indicates that all the rates quoted are probably lower than would reasonably be allowable, as the charges made to engineering costs are practically direct disbursements only and include little or no indirect costs properly chargeable to engineering expense.

(*h*) The Holland Vehicular Tunnel under the Hudson River at New York City, involved a 10-year period of investigation and construction, during 7 years of which a vast engineering research of absolutely original character was conducted as to the effects of poisonous gases, and ventilation for their removal, the expense of which was chargeable to engineering cost. On this work, which for complete construction and equipment cost $36 000 000, the total engineering charges aggregated $4 000 000, or at a rate of 11.1 per cent.

(*j*) For the construction of the great suspension bridge over the Delaware River, at Philadelphia, Pa., the complete engineering cost aggregated 7.00% of the total cost of construction, which amounted to approximately $23 000 000.

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* *Engineering News-Record*, December 6, 1928.

† *Loc. cit.*, December 13, 1928.

VI.—RATES

Rates as Percentages of Cost.—The foregoing study of various methods of computing charges for professional service, presents more or less definite recommendations in respect to the charges under all the methods specified except Method No. 1, under which rates are computed as percentages of the cost of the work.

Attempts have been made by professional associations, as well as by individuals, both in Europe and in the United States, to establish by curves or by tabulations, precise minima rates. The combined engineering societies in Germany recognized the impossibility of tabulation applicable to engineering works of a simple type and to those of a complicated character involving extensive study, research, and development. Instead it recommends three separate tabulations, applicable to the different types of service. Of these, Class 1 referring to earthwork, simple bridges, etc., has not been considered herein. The North Carolina Society of Engineers similarly subdivides, by graphical illustration, three distinct classes of service with description of the types of work involved in each class.

The American Association of Engineers, graphically defines the rates of percentage to be charged on (*a*) "Structures and Plants", and (*b*) "Spread Work".

Generally, however, a single scale is used as applicable to all kinds of engineering work, although the individual engineer, specializing along a particular line, often adopts rates applicable to his own special work, such as to yield adequate profit to himself.

Foreign societies commonly recommend a flat rate, irrespective of character of service, and, to some extent, disregard also the value of work represented. There can be no doubt, however, that no precisely defined and equitable rate can be established, even for a definitely specialized service, without previously considering all the elements involved.

By plotting the various scales side by side, it is found that the divergence between the rates in Europe and the United States, occurs for work not exceeding $150 000 in cost. For engineering construction involving costs in excess of this sum, the scales are generally similar, allowing for the variable character of the work represented.

To illustrate this, Figs. 1 and 2 are plotted for a few only of the many scales, also a composite curve based on replies to the questionnaire sent out by the Committee, with the co-operation of the Local Sections, to various practicing and consulting engineers.

Apparently, the keenest competition is within the lower range of cost, up to approximately $150 000 or $200 000. This work is without doubt proportionately more costly than the larger undertakings extending into the millions of dollars value, when computed on a percentage-of-cost basis. Consequently, it should require materially higher rates; at the same time, in the anxiety to get work, unfortunately, there is the greater tendency to cut rates below the recommended minima, resulting in quite inadequate compensation.

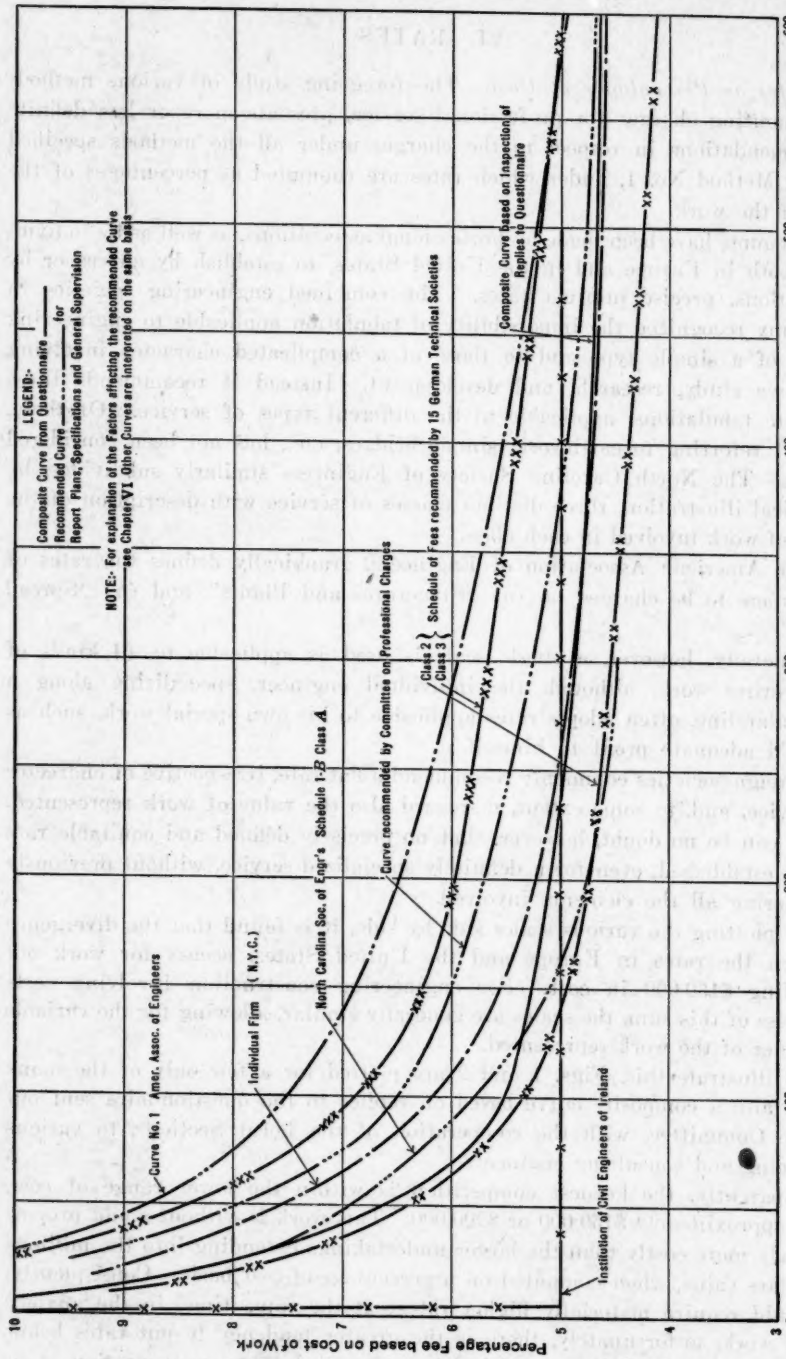

FIG. 1.—DIAGRAM OF SCHEDULE OF FEES OF VARIOUS SOCIETIES AND INDIVIDUALS, FOR WORK COSTING UP TO $600 000.

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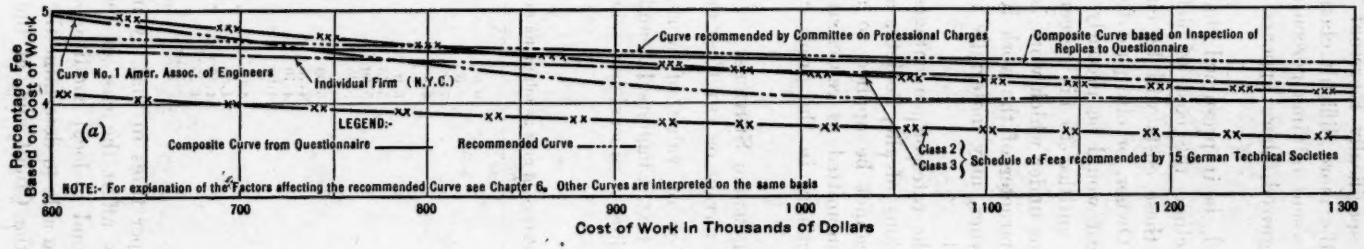

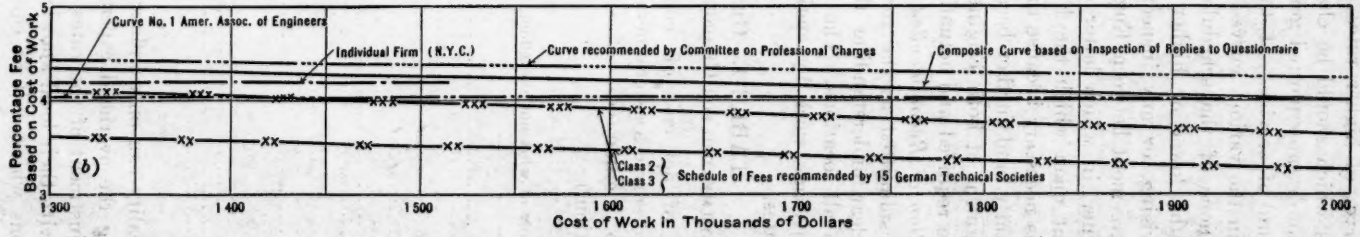

FIG. 2.—DIAGRAM OF SCHEDULE OF FEES OF VARIOUS SOCIETIES AND INDIVIDUALS, FOR WORK COSTING MORE THAN $600 000.

The curves of higher rates as plotted specifically represent the minima percentages which should be charged for the more difficult classes of work; while the lower rates plotted generally represent minima percentages for the ordinary run of service. If this is recognized, there appears to be little difference in the various curves.

Under none of the schedules presented, is it presumed that the rates, either on the lower or higher scales, include the cost of field engineering, supervising, or any inspection. All these costs will be charged on a separate agreement between Engineer and Owner, or else paid for separately by the Owner, in which latter case the cost would be properly included as part of that upon which the Engineer is entitled to his percentage. This procedure is necessary because the conditions under which work is carried out vary so greatly, and further because the character of the work itself, as well as the judgment of both Engineer and Owner, may materially influence the field service required and actually employed.

Tabulation of Recommended Rates.—The rates or percentages (Table 1), which are submitted as the recommendations of the Society, are prepared with the clear understanding that they cannot be applied to all kinds of work or to all locations. The data are submitted as representing minima rates for average work by engineers practising in the great cities of the United States.

TABLE 1.—GENERAL ENGINEERING SERVICES:
RATES RECOMMENDED FOR CHARGES AS A PERCENTAGE OF THE COST OF THE WORK.

(In terms of net cost of construction or of value of work. Fees for detailed services as enumerated in the text, Chapters III and VI. Rates not to include cost of surveys, resident supervision, shop, or field inspection.)

Net cost of work not exceeding:	Percentage of cost as minimum rate for charges.
$ 25 000	9.5
50 000	8.0
75 000	7.0
100 000	6.5
150 000	6.0
200 000	5.75
250 000	5.50
300 000	5.25
400 000	5.00
500 000	4.75
600 000	4.70
700 000	4.65
800 000	4.60
900 000	4.55
1 000 000	4.50
2 000 000	4.25

The locality can only influence the proper rates in that, by increasing or diminishing the overhead expenses, it may affect the cost of service.

For adjustment of the rates to correspond to local conditions, individual engineers with their local knowledge, will be able to determine the appropriate modifications which will be equitable to the Client and, at the same time, yield adequate return.

It is recommended that no precise determination of a percentage rate applicable to any particular engineering work, can be provided by any general tabulation; but the information given, as resulting from the experience of other professional engineers, will serve as the basis upon which an Engineer may establish a fair rate applicable to work under consideration for which all the governing factors are disclosed.

The service to be rendered includes preliminary study, investigation, and report on the project; preparation of plans; estimate of quantities and cost; specifications; letting of contracts; supervising the laying out of the work by the principals; computation of estimates, preparation of working drawings, as well as the checking of working drawings required of the contractors; consultation and advice to the Client during construction, including, also, the general direction by principals of the conduct of the work to conclusion.

It is to be noted that the rates do not include surveys, resident supervision, or field inspection. These are to be charged as a cost of service to the Client. Nor do these rates include the incidental expenses, such as traveling, printing, etc., unless otherwise agreed upon at the time of original employment.

The cost of preliminary investigation is commonly included in the fee. It varies so much that proper weight should be given in establishing the fee. When soundings, borings, tests, etc., are required, it is usual to charge such expenses at actual cost, entirely separate from the engineering fee.

In the use of a percentage-of-cost method, the most common reason for dissatisfaction arises from the lack of definite previous determination as to what is, or is not, included. Construction work of any type necessitates surveying, monumenting, and laying out the work in detail, as well as giving, lines and grades at all stages. This work is conducted usually by a Resident Engineer with an adequate field corps. The cost of this supervision, including camp expense, is part of the expense of work. It is not to be included in the scheduled rate for engineering, but, as agreed upon, may be accounted additional services as net expense to the owner, in which case the amount is properly added to that upon which the percentage rate may be applied. (See page 243.)

For an average type of work the cost of resident supervision and surveys will approximate 1½% of the cost of construction; or even a higher figure, depending on the difficulties of the work. To be included in the same category and similarly accounted for, is the cost of field as well as of material inspection.

In arriving at a percentage rate, consideration must be given to the cost of traveling and subsistence, on work remote from the headquarters. Prior agreement should be effected before work is commenced.

A rate of percentage of cost may be materially changed by the effect of climatic conditions on the continuity of the work. In climates where either severe winter weather or tropical floods in wet seasons interfere with construction, allowance must be made. Where such conditions occur, the field supervision should be excluded from the rate for the fee and transferred to the cost of work.

In proposals for employment it is desirable to establish the percentage rate in advance. It may be necessary to agree upon a rate based on a prelim-

inary estimate of the probable cost of the project, whereas the earnings will be computed on the ultimate actual net cost.

In determining a rate, consideration must be given to the element of time occupied in promotion, study, development, and construction, as well as to whether the work is to be spread over a large territory or is localized. (See page 273.)

This percentage employment presupposes a reasonable maximum time within which the service is to be rendered. Should this be greatly extended by the fault of the Client, the Engineer should receive compensation in some way for his added costs. This is equitable since the Engineer may be under the necessity of carrying an expensive organization and heavy overhead charges for which he is in no way responsible. Suitable provision to cover this contingency should be inserted in the contract. It is customary in these cases, to make charges for the idle time of the staff, with the addition of 25% on salary cost. (See pages 240, 245, 247, 260, and 263.)

Consideration should also be given to the increased service, and consequent cost, in works built under a large number of separate contracts involving considerable co-ordination, over that necessary under general contracts.

Rates for engineering work of intricacy in any specialized line must be increased above those quoted to meet the conditions which the experience of the Engineer will indicate to be necessary. Similarly, should the conditions of employment eliminate any of the elements of expense, or should the work be of such simple character as to reduce materially the engineering service, the rates may be reduced somewhat below those specified.

On the assumption that negotiations for employment are initiated by an Engineer with a Client, it is necessary to have definite determination of:

(*a*) Personal service;
(*b*) Assistance in all grades; and,
(*c*) Overhead and expense;

and upon that predetermination to assess the suitable rate. The complete service may include any or all of the following steps.

Stages in Engineering Service for Compensation

(*a*).—*Consideration of the Project.*—This includes preliminary expenditures for conferences, study, investigation, and preliminary report on project. This work should be represented by a lump-sum payment on account, adequate to cover expenses and a suitable fee to the engineer, which will be chargeable against the sum total received for the complete work; or, either as a part or full payment, if the project is abandoned.

(*b*).—*Procedure with Project.*—This work includes the field surveys, examination of sites, and general investigation necessary for, and the procedure with, plans, construction specifications, and preliminary estimates of cost.

(*c*).—*Procedure with Actual Authorized Undertaking.*—This relates to the preparation of complete detailed plans for furnishing to contractors, estimation of quantities, preparation of construction specifications, and work with legal representatives in the preparation of forms of contract, laying out and pur-

chase of properties and rights of way. The work includes, also, invitation to contractors, receipt, scheduling and comparison of bids and report to owners, selection of contractor, and award and execution of contracts.

In case for any reason the contract is not executed, the Engineer is entitled to payment for plans and specifications at the full agreed percentage rate.

(*d*).—*Engineering on Construction.*—The preparation of shop details and working drawings by the Engineer if called for, and in any event the study of all working drawings submitted by the Contractor to be examined, checked, and approved, is discussed under this heading. It also includes resident field supervision and engineering; laying out the work in the field; inspection of materials and of construction and erection; preparation of record drawings of all work as executed; estimates of quantities for progress estimates; and preparation of current estimates for payment to contractors.

(*e*).—*General Supervision.*—This applies to work by principals or by representatives of the Engineer, in consultation and advice with owners, contractors, and other interested parties on all matters arising during procedure of contracts; in adjustment of any claims of contractors arising out of the work; in personal oversight of preparation of final estimates, and general direction of final clean-up and finish of the work; and in the final report to owners, including assemblage of all drawings and records of the work.

(*f*).—*Legal Service.*—The Engineer must be prepared to act in relation to possible arbitration or Court proceedings arising out of the work. This service is subject to subsequent arrangements and may or may not be considered as part of the obligation of the Engineer.

TABLE 2.—STRUCTURAL STEEL CONSTRUCTION, GENERAL PRACTICE: RATES RECOMMENDED FOR CHARGES AS A PERCENTAGE OF THE COST OF THE WORK.

(Rates between given limits to be determined by the judgment of individual Engineer. Percentages based on cost of steel erected, assumed for maximum classification as $125 per ton, and for minimum classification as $70 per ton. Rates include design and plans, location of column centers, specifications, and checking only in respect of adequacy and strength of Contractor's working or shop drawings, and control points for location of all steel. (See Chapter IV for further details.)).

Total cost of structural steel:	LIMITS OF RATES, IN PERCENTAGE.	
	Maximum (for theatres, churches, etc.).	Minimum (for business buildings*).
$ 10 000 to $ 50 000	6.50	3.50
50 000 to 100 000	6.25	3.38
100 000 to 200 000	6.00	3.25
200 000 to 300 000	5.75	2.88
300 000 to 500 000	5.50	2.63
500 000 to 1 000 000	5.25	2.38
1 000 000 and more	5.00	2.25

* Subjected to live loads of more than 120 lb. per sq. ft.

TABLE 3.—STRUCTURAL STEEL CONSTRUCTION, DETAILED SUPERVISION: RATES RECOMMENDED FOR CHARGES AS A PERCENTAGE OF THE COST OF THE WORK.

(Rates between given limits to be determined by the judgment of the individual Engineer. Percentages based on cost of steel erected, assumed for maximum classification as $125 per ton, and for minimum classification as $70 per ton. Rates include shop details of structural steel, complete erection plans, material orders, shop details of all material, and shop bills. Rates do not include mill, shop, or field inspection. (See Chapter IV for further details.)).

Total cost of structural steel.	LIMITS OF RATES, IN PERCENTAGE.	
	Maximum (for theatres, churches, etc.).	Minimum (for business buildings*).
Less than $ 50 000	10.5 to 13	5.5 to 7.5
$ 50 000 to $100 000	9.5 to 11.5	4.5 to 6.5
100 000 to $200 000	8.5 to 10.5	3.5 to 5.5
More than $200 000	7.5 to 9.5	2.5 to 4.5

* Subjected to live loads of more than 120 lb. per sq. ft.

Tabulation of Recommended Rates.—Rates given in Tables 2 and 3 relate to engineering service in design and construction of structural steel work for buildings already covered in detail. The rates apply to the method of making charges as a percentage of the cost of construction.

Charges for detailing structural steel work are made more usually on the basis of a price per ton of steel than upon the percentage rates indicated in Table 3.

Interim Payments.—The Engineer is entitled to interim payments for service as the work proceeds, all such payments being charged against his account as finally determined. Usually, however, it is impossible to stipulate any hard and fast amounts at the various stages and the contract for service should provide for these details, differing with each job according to the conditions involved.

Further, it is necessary to provide for some method of adequate compensation in the event that work projected should for any reason be abandoned or deferred at any stage. Hence, it is necessary, in determining the interim payments, to properly "weight" the amounts payable for the early stages of a project, so as more truly to represent the service rendered. The percentage for a complete project must be assessed on all work constructed, including mechanical and electrical equipment, for which the service of the Engineer has been in any way employed.

VII.—EDUCATION OF CLIENTS AND ENGINEERS

The education of the Client, in professional ethics and conduct, is just as important to the profession of engineering as the education of the individual practicing Engineer, and is far more difficult to accomplish.

The Engineer can and should receive the ground work of his ethical education in the universities as an essential part of his professional training. Later, when in actual practice, there are means for disciplining those who are members of the reputable engineering societies, for definite infractions of the codes. The principles taught to a youth before his practical contact with business affairs are more likely to affect his future conduct beneficially than if they are left to be learned in the rough school of practicing competition for work.

A vast responsibility rests with the schools. Some of the larger institutions appear to be slowly recognizing a measure of this, but not to the extent that should prevail, as evidenced by many instances reported.

There seems to be but one practical way of reaching the Client permanently and successfully and that is by a firm, continued, and united display, on the part of all members of the Engineering Profession, of honorable conduct in dealing as individuals with prospective clients. It is in the personal conduct of the individual Engineer with the Client that response may be anticipated. Undoubtedly, it is within the power of engineers as a body in honorable competition for employment on merit, and not by unethical means to improve their relations with clients and to elevate the clients themselves. The profession can then expect to receive the same treatment that it deals out to the Client. The burden rests with the engineers.

If the Engineer is to command the fees to which he is entitled and which his education warrants, it must be by co-operation to raise the standing and public recognition of the profession, by concerted action and decent behavior; and not by attempts to cut rates proposed by brother engineers, to the grave detriment of the profession.

J. Vipond Davies, *Chairman*,

H. Eltinge Breed,
W. W. Colpitts,
C. W. Hudson,
W. S. Kinnear,
J. R. McClintock,
I. W. McConnell,
Ralph Modjeski,
R. R. Rumery,

J. F. Sanborn.

July, 1929.

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Meetings and Publications

Report of Committee

TO THE BOARD OF DIRECTION,
AMERICAN SOCIETY OF CIVIL ENGINEERS:

Last year (1928), this Committee, together with the Technical Expansion Committee, considered at length ways and means of improving and stimulating the technical activities of the Society.

At the Annual Convention in Buffalo, N. Y., in July, 1928, the Board on the recommendation of the two Committees mentioned, approved in part a report outlining the principles on which the Publications and the Technical Divisions should be strengthened and improved.

A year having elapsed since these recommendations were placed in effect, this Committee believes that it should report on the results achieved to date by these measures.

Technical Divisions

The change in the Constitutions of the Technical Divisions, providing for a continuing personnel on the Executive Committees, is accomplishing its desired purpose of stabilizing Division management and will produce continuing programs for effective work.

Evidence is available that, since this provision went into effect, the Executive Committees have started to plan long-term programs for technical committee work with every expectation of reasonable accomplishment.

This Committee is gratified to report that a large majority of the Division Committees are active and that worth-while results may be expected.

The Executive Committees of the Divisions are to be commended on the manner in which they have acted upon the instructions from the Board and on their accomplishment in the short time the changes have been in effect.

Publications

The report to the Board of Direction at the Buffalo Meeting also put into effect a drastic policy with respect to the editing of papers and discussions. Although some unfavorable reaction from the more stringent policy was expected, it is gratifying to report that by and large the membership has approved the policy of eliminating "dead wood" in the published material. Very few objections on the part of members have been reported to this Committee for settlement.

In view of suggestions that have been considered for possible improvement in the publications, this Committee reports its opinion on what the publications should constitute as the major activity of the Society.

What the Society is to print may be more readily defined if *Transactions* as well as "Separates" be considered as reprints from *Proceedings*.

Proceedings

Part II.—Part II of *Proceedings* is an entirely separate matter and may be continued or discontinued at pleasure. It properly should not be called *Proceedings*, but it is so designated to avoid the expense of separate mailing.

Part III.—Part III of *Proceedings* is simply an extra volume of Part I issued from time to time as the case permits and will usually be a single paper of considerable extent or a group of papers on a single topic.

Part I.—Part I of *Proceedings* is thus the main vehicle for conveying technical information to the membership, and it should be viewed as one volume, embracing within its annual covers a well-rounded technical service.

Proceedings is therefore a working tool and has a format resulting from the strictest economy in paper, in type, in covers, and in other physical details. It is designed to be efficient rather than attractive. Were it to be made attractive, the expense would be increased enormously, and the character of the technical material would have to be popularized.

Proceedings, Part I, therefore, should be viewed as a carefully selected aggregation of material of an extent permissible within its budget appropriation. It should be as nearly as practicable of service to all members. It must contain, therefore, technical matter of varying theoretical degree. The sources of this technical matter are several and should be considered primarily on the basis of the value of the produced material to all the membership.

This material may be classified as follows:

1.—Volunteer papers.
2.—Solicited papers.
3.—Society Committee reports.
4.—Division Committee reports.

Volunteer Papers.—Volunteer papers constitute one of the sources of material of value in advancing the art and science of engineering. So far as practicable, encouragement should be extended to members to prepare suitably and send in for publication the results of their work, whether in the field of theory, or practice. Through such papers and discussions the scope of the publications is kept broad and progress stimulated.

Solicited Papers.—This Committee regrets that too frequently engineers do not find the time to prepare papers on the outstanding engineering works of the country and thus changes in the art and the reasons therefor are not recorded.

With respect to such papers which would explain in concise form the trends and developments in engineering practice, this Committee believes that a departure should be made from the policy of years and that as the case warrants papers of this character should be solicited.

Technical Division Papers.—From the Technical Divisions also there may be expected papers which arise out of Division Sessions at Society meetings. In general, Division meetings are not directed for the present at publications, but at audiences, and the staff-made abstracts, such as those prepared for the 1929 Annual Meeting, suffice for publication. This should not be a rigid rule, and care should be taken to select from the abstracts such papers as should be printed in full or developed for publication.

Ultimately, however, it should be the purpose of many, if not all, Division meetings to develop papers and discussions of such merit as to warrant publication substantially in full, subject to adequate editing.

Society Committee Reports.—Society research committee reports may also be viewed generally as advancing the art and as such should occupy a portion of *Proceedings.*

Technical Division Committee Reports.—From the Technical Divisions there may be expected Committee reports on various subjects and quite generally they will not be theoretical, but will be of increasing practical value to the membership. In general, they may be expected to have the nature of codifications. They should all be printed, although drastic editing may be necessary in cases. Such of these reports as are subject to revision in the light of discussion should be printed in the *Proceedings,* discussed there, and, subsequently, reprinted in corrected form in the series of "Separates" or Manuals.

Transactions

As recommended by this Committee, *Transactions,* as distinguished from Manuals, should contain such technical matters of permanent value as are worthy of consideration for the Society's prizes (in addition to Memoirs).

The Series of "Separates"

From time to time Committee reports of value for frequent reference should be reprinted in the form of "Separates" which, as they accumulate, will constitute a valuable reference collection for practical use. Several of the Divisions have in preparation reports that should appear in this form.

Technical Division Committees

The nine Technical Divisions have a total of 43 committees. Of these, 8 are standing committees to take care of Division matters as the occasion arises.

Thirty-five of the committees have been assigned specific topics for study and report. Of these 35 committees, 6 are newly appointed.

The nature of the work of these committees varies to some extent; that is, some are engaged on matters which will result in the production of "Separates", whereas others are studying problems and making progress reports from year to year.

The work of 4 of the committees has been conducted with the idea of producing Manuals. These Manuals will cover the following topics: Construction Plant and Methods; Canal Lock Valves; Piles and Pile-Driving; and Boundary and Control Surveys.

General Program

From the preceding comments this Committee believes that this program eventually will involve increased expenditures of money for publications.

The solicitation of papers involves publication within a reasonable time after receipt. The reports and separates that may be expected from the various committees will eventually increase the bulk and cost of *Proceedings.*

For the more expensive type of report and paper, this Committee hopes to be able to finance the publication in part by funds from outside sources as

was done with the report on the Stevenson Creek Arch Dam. Negotiations have been concluded for printing a number of papers dealing with the outstanding features of the Hudson River Bridge, the Port of New York Authority to bear a very substantial part of the cost. Negotiations also are now in progress with a view of obtaining outside funds for publication of the very costly report of the Special Committee on Effects of Earthquakes on Engineering Structures with Special Reference to the Japanese Earthquake of September 1, 1923.

This Committee also desires to lend encouragement to the Juniors and younger members to send in notes about their work. The department in *Proceedings* of "Notes from Juniors" authorized by this Board has not yet been started because of insufficient material to fill an assigned space regularly. This Committee, therefore, requests the Secretary to take suitable further steps to encourage the Juniors and younger members to send in short articles on their engineering work.

In short, this Committee wishes to make the *Proceedings* broad in character and its usefulness so extended that its value will induce greater support both inside and outside the Society.

Recommendations

In consideration of the information given in this report, it is recommended:

(1) That Division Executive Committees be requested to offer suggestions for the solicitation of papers of outstanding merit, these suggestions to be included in a report of the Division's activities for the year and its proposed activities for the year following, and accompany the Divisions' annual request for Society funds, to be received by the Secretary of the Society not later than October 1 of each year.

> This information on behalf of all the Divisions will enable the Meetings and Publications Committee to obtain a long range view of the publication needs of the Technical Divisions and will aid the Committee in budgeting space and time for the appearance of papers and reports in *Proceedings* and *Transactions* as well as assist the Board in budgeting funds.

(2) That the policy of past years of printing Memoirs in *Transactions* be continued.

> On the recommendation of this Committee at the Buffalo Meeting, it was decided to print memoirs only in *Proceedings,* but from reports received it is felt that the reaction of the membership is unfavorable to the proposal, and that it is wise to continue the practice of the past.

(3) That the publication appropriation for 1929 be increased by $3 000 in order to provide:

> (*a*) For about 200 pages of Memoirs in the forthcoming volume of *Transactions.*
> (*b*) For a slightly increased size of *Proceedings* for the remainder of the year, and in order to assist the Committee's program of preparing papers in concise form and printing them promptly.

(4) That the policy be approved, for the present, of printing in *Proceedings* an abstract of all the technical sessions of the Quarterly Meetings as was done with the last Annual Meeting.

This practice presents in condensed form a great deal of technical information and discussion to the members promptly after a meeting and relieves the pressure of considering papers that are of more or less transient interest, without injuring papers of outstanding merit.

(5) That space in Part II be allotted as occasion demands to the Technical Division Executive Committees for communications relating to Division activities.

This practice will meet the need, of which the Committee has been aware for some time, for some means of better contact between Executive Committees and their memberships as to Division policies and performances.

(6) That the policy of negotiating for financial assistance in the printing of very costly and valuable reports and papers be approved.

This is not a new procedure, the first instance being the issuance of the report on the Stevenson Creek Dam, the cost of printing having been borne jointly by the Society and Engineering Foundation.
As stated previously, negotiations have been concluded for printing a number of papers on the Hudson River Bridge, a substantial part of the cost being borne by the Port of New York Authority. Assistance is also being sought for the printing of the report of the Earthquake Committee.

It is reported for the record:

That the Style Manual authorized by this Board for the guidance of authors in the preparation of papers has been prepared and will be issued shortly.*

Respectfully submitted,

GEORGE W. FULLER, *Chairman,*
F. O. DUFOUR,
HARRISON P. EDDY,
MALCOLM PIRNIE,
Committee.

July 8, 1929.

* The Manual is printed in this number of *Proceedings*, p. 221.

Meetings of the Board of Direction

This is an abstract of the notes of the Secretary and subject to approval by the Board of Direction at its next meeting.

The Board met at Milwaukee, Wis., on July 8 and 9, 1929; President Anson Marston in the chair; George T. Seabury, Secretary; and present, also, Messrs. Bell, Brillhart, Budd, Bush, Dennis, Dufour, Dyer, Eddy, Fowler, Fuller, Hammond, Jacobs, Johnston, Lucas, Morris, Norton, Pirnie, Reichmann, and Stevens.

Approval of Minutes

The minutes of the meetings of the Board of Direction held on April 22 and 23, 1929, were approved.

Special Committee on Charges and Method of Making Charges for Professional Services

The Report of the Special Committee on Charges and Method of Making Charges for Professional Services was presented and discussed.

On motion, the report was ordered published in *Proceedings** for comment, the comments received to be transmitted to the Committee in order that it may revise the report, if it deems such action advisable, in the light of the discussion received, after which a final report is to be submitted to the Board for action.

In view of the excellence of the report, an expression of appreciation was voted to the Committee for the splendid manner in which it had performed its work.

John Fritz Medal Board of Award

President Marston was appointed as one of the Society's four representatives on the John Fritz Medal Board of Award on the expiration of the term of Past-President Robert Ridgway.

Summer School for Engineering Teachers

In response to a request from the Society for the Promotion of Engineering Education, authority was granted for co-operation and support of the Summer School for Engineering Teachers at Yale University, and the question of an appropriation of $2 500 was referred to the Executive Committee, with recommendation that such amount be provided in the 1930 budget.

* See p. 236.

American Standards Association Reports on Engineering Symbols Approved

On recommendation of the Society's representative, C. M. Spofford, M. Am. Soc. C. E., the report on Symbols for Photometry and Illumination and the report on Navigational and Topographical Symbols were approved.

Phebe Hobson Fowler Awards

On the recommendation of the Phebe Hobson Fowler Professional Award Committee (consisting of the President and the four Vice-Presidents), the Board approved the following awards:

First Prize.—LEONARD C. WASON. As a Recognition of His Work as Chairman of a Committee of the Northeastern Section Which Developed the Code of Practice Adopted by the Society.

Second Prize.—LEWIS B. STILLWELL. For Leadership, as Chairman of Engineering Foundation, in Consolidating the Research Activities of Foundation and the Engineering Societies.

Third Prize.—CLARENCE F. BELL. In Recognition of His Executive Ability, as President of the Association of Engineers of New York, and His Achievements in Enhancing the Financial Status, of the Engineering Employees of New York City.

Similarly, on the recommendation of the Phebe Hobson Fowler Architectural Award Committee consisting of Messrs. George H. Pegram, *Chairman;* William Adams Delano, Charles D. Marx, William A. Starrett, and R. L. Walker, awards were approved as follows:

First Prize.—GUSTAV LINDENTHAL. For the Design of the Steel Arch Bridge across the East River at Hell Gate, New York.

Second Prize.—JOHN D. STEVENSON. For the Design of the Beechwood Boulevard Bridge (Concrete) at Pittsburgh, Pa.

Third Prize.—EDWARD L. WOODRUFF. For the Design of the San Pedro Lighthouse, California.

Committee on Meetings and Publications

The Meetings and Publications Committee presented a report dealing with a number of matters relating to publications. The report after approval was ordered printed in *Proceedings* for the information of the membership.*

Committee on Professional Conduct

The Committee on Professional Conduct reported on five complaints that had been brought to its attention.

Working Committee Reports

In addition to the items enumerated, the Board considered and acted on the reports of nine Committees including, Joint Conference Committee; Com-

* See p. 285.

mittees on Technical Procedure; Student Chapters; Public Relations; Honorary Membership; Research; Registration of Engineers; Local Sections; and Districts and Zones.

Alfred Noble Memorial Prize Committee

Messrs. C. M. Spofford, *Chairman,* J. Vipond Davies, L. P. Alford, H. P. Charlesworth, and E. T. Howson (representing the Civil, Mining, Mechanical, Electrical, and Western Society of Engineers, respectively), have been appointed as the Alfred Noble Memorial Prize Committee.

Local Sections*

Colorado.—June 22, 1929. A regular meeting of the Section, which took the form of an outing to which the ladies and children were invited for the afternoon and evening, was held at Navajo Lodge, Indian Hills. The afternoon was spent in visiting and games, after which dinner was served. A report of the election of officers for the year 1929-1930 was given and Retiring President Curtis made a few informal remarks. He then introduced Mr. Ivan E. Houk, the new President, who also spoke briefly. Following the business session, the evening was concluded with dancing and bridge. Attendance 38.

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* For list of Local Section Officers, Rules, etc., see 1929 Year Book, p. 46.

Engineering Societies Library

The services of the Engineering Societies Library are available to all members who wish searches, copies, translations, etc., or advice on technical literature. A collection of modern books is also available for loan to members in North America, at moderate rentals. Correspondence should be addressed to the Director, Engineering Societies Library, 29 West 39th Street, New York, N. Y., who will gladly give information concerning the charges for the various kinds of work. A more comprehensive statement in regard to this matter will be found on pages 73 and 74 of the Year Book for 1929.

Book Notices*

(July 1 to July 31, 1929)

Airplane Structures. By Alfred S. Niles, Assoc. M. Am. Soc. C. E., and Joseph S. Newell, Jun. Am. Soc. C. E. N. Y., John Wiley & Sons, 1929. 413 pp., diagrams, tab., 9 x 6 in., cloth. $5.00.

This book aims to combine an exposition of structural theory with sufficient practical information to solve the more common problems of the aeronautical structural engineer. Data on the allowable stresses in various materials and the allowable loads on standardized airplane parts are included.

Walzwerkswesen; Vol. 1. Edited by J. Puppe and G. Stauber. (Handbuch des Eisenhüttenwesens.) Düsseldorf, Verlag Stahleisen; Berlin, Julius Springer, 1929. 777 pp., illus., pl., diagrams, tab., 11 x 8 in., cloth. 85.—r.m.

This is the first of four volumes of the most exhaustive treatise on the rolling of iron and steel ever published. It has been prepared under the auspices of the German Society of Ironmasters, by well-known specialists. This volume contains sections on the economic importance of rolling mills; the evolution of rolling, properties of malleable and rollable iron, the constitution of metals, testing of materials, specifications and standards, cost accounting, operation and supervision, the rolling process, rolls, and roll trains.

Additions to the Reading Room

Population, Land Values, and Government: Studies of the Growth and Distribution of Population and Land Values; and of Problems of Government. By Thomas Adams, Harold M. Lewis, M. Am. Soc. C. E., and Theodore T. McCrosky, Jun. Am. Soc., C. E., and Others. (Regional Survey, Vol. II.) N. Y., Regional Plan of New York and Its Environs, 1929. 320 pp., illus., maps, tab., 11 x 8½ in., cloth. $3.00. (Gift of Mr. Lewis.)

As a statistical and economic study this volume has a direct appeal to engineers and city planners, especially the complete graphical data, including colored maps. The various special topics have been handled comprehensively, and the result throws valuable light on large-scale civic development. Statistics are given, related problems discussed, and solutions suggested.

Physical Conditions and Public Services. By Harold M. Lewis, M. Am. Soc. C. E., and Others (Regional Survey, Vol. VIII.) N. Y., Regional Plan of New York and Its Environs, 1929. 209 pp., illus., maps, tab., 11 x 8½ in., cloth. $3.00. (Gift of Mr. Lewis.)

This volume gives the results of several Metropolitan engineering studies of major importance, dealing with geography and climate; water supply and sewage; refuse disposal and oil pollution; power, light, and other supply services; and hospitals and prisons. Historical material and concluding observations on the regional study in its entirety round out the volume. For its technical value and as a standard of excellence in similar surveys, it should find great use among engineers.

* The statements made in these notices are taken from the books themselves, and this Society is not responsible for them. Unless otherwise specified, the books in this list have been donated by publishers.

Current Civil Engineering Literature

Key to Abbreviated References to Publications Indexed*

Abbreviated References.	Publication.	Place.
Am. C. Inst.	*American Concrete Institute, Proceedings* (Y.)	Detroit
A. I. E. E.	*American Institute of Electrical Engineers Journal* (M.)	New York
A. R. E. A.	*American Railway Engineering Association, Proceedings* (Y.)	Chicago
A. S. T. M.	*American Society for Testing Materials, Proceedings* (Y.)	Philadelphia
Am. Soc. C. E.	*American Society of Civil Engineers, Proceedings* (M.)	New York
Am. Soc. Mun. Impvts.	*American Society for Municipal Improvements, Proceedings* (Y.)	New York
Am. W. W. Assoc.	*American Water Works Association, Journal* (M.)	Baltimore
Am. Wood Prs. Assoc.	*American Wood Preservers Association, Proceedings* (Y.)	Chicago
Ann. P. et C.	*Annales des Ponts et Chaussées* (Bi-M.)	Paris
Ann. T. P. Belg.	*Annales des Travaux Publics de Belgique* (Bi-M.)	Brussels
Assoc. Ing. Gand.	*Annales de l'Association des Ingénieurs sortis des Ecoles Spéciales de Gand* (Q.)	Ghent
Bost. Soc. C. E.	*Boston Society of Civil Engineers, Journal* (M.)	Boston
Can. Engr.	*Canadian Engineer* (W.)	Toronto
City Plan.	*American City Planning Institute* (Q.)	Boston
Comwlth. Engr.	*Commonwealth Engineer* (M.)	Melbourne
Conc.	*Concrete* (M.)	Chicago
Cornell C. E.	*Cornell Civil Engineer* (M.)	Ithaca
Dock & Harbour	*Dock and Harbour Authority* (M.)	London
Eng.	*Engineering* (W.)	London
Eng. & Contr.	*Engineering and Contracting* (M.)	Chicago
Eng. Inst. Can.	*Engineering Institute of Canada, Journal* (M.)	Montreal
Eng. N. R.	*Engineering News-Record* (W.)	New York
Engr. Soc. W. Pa.	*Engineers' Society of Western Pennsylvania, Journal* (M.)	Pittsburgh
Engr.	*Engineer* (W.)	London
Engrs. & Eng.	*Engineers and Engineering, Engineers' Club of Philadelphia* (M.)	Philadelphia
Gas und Wasser.	*Gas und Wasserfach*	Munich
Gen. Civ.	*Le Génie Civil* (W.)	Paris
Gesund. Ing.	*Gesundheits Ingenieur* (W.)	Munich
Hydraulic Eng.	*Hydraulic Engineering* (M.)	Los Angeles
Inst. C. E.	*Institution of Civil Engineers Minutes of Proceedings* (Q.)	London
Inst. Mun. & Co. Engrs.	*Institution of Municipal and County Engineers, Journal* (W.)	London
Int. Ry. Cong. Assoc.	*International Railway Congress Association, Bulletin* (M.)	Brussels
Land. Arch.	*Landscape Architecture* (Q.)	Boston
Mech. Eng.	*Mechanical Engineering* (M.), *Journal of the American Society of Mechanical Engineers*	New York
Mil. Engr.	*Military Engineer* (Bi-M.)	Washington
Min. & Metal.	*Mining and Metallurgy* (M.), *American Institute of Mining Engineers*	New York
Mun. N. & W. W.	*Municipal News & Water Works* (M.)	Chicago
N. E. W. W. Assoc.	*New England Water Works Association, Journal* (Q.)	Boston
N. Y. R. R. Club	*New York Railroad Club, Proceedings* (M.)	Brooklyn
Oest. Ing. Arch. Ver.	*Oesterreichischer Ingenieur und Architekten Verein, Zeitschrift* (F.)	Vienna
Power	*Power* (W.)	New York
Public W.	*Public Works* (M.)	New York
Rev. Gen.	*Revue Générale des Chemins de Fer* (M.)	Paris
Ry. Age	*Railway Age* (W.)	New York
Ry. Eng. & Main.	*Railway Engineering and Maintenance* (M.)	Chicago
R. & S.	*Roads and Streets* (M.)	Chicago
Schw. Bauz.	*Schweizerische Bauzeitung* (W.)	Zurich
Sci. Am.	*Scientific American* (M.)	New York
Soc. Ing. Civ. Fr.	*Société des Ingénieurs Civils de France, Mémoires et Comptes Rendus* (Q.)	Paris
Tech. Gemein.	*Technisches Gemeindeblatt* (F.)	Berlin
Ver. deu. Ing.	*Verein deutscher Ingenieure, Zeitschrift* (W.)	Berlin
West. Constr. N.	*Western Construction News* (F.)	San Francisco
West. Ry. Club	*Western Railway Club, Proceedings* (M.)	Chicago
West. Soc. Engrs.	*Western Society of Engineers, Journal* (M.)	Chicago
Zeit. Bau.	*Zeitschrift für Bauwesen* (Q.)	Berlin
Z. d. Bauver.	*Zentralblatt der Bauverwaltung* (W.)	Berlin

* Y = Yearly; Q = Quarterly; M = Monthly; F = Fortnightly; W = Weekly.

B. Applied Mechanics

a. Mechanics of Solids (Strength of Materials)

6. Heterogeneous Solids (Reinforced Materials)

Reinforced Concrete Design Simplified.* James R. Griffith. Conc. June, '29.

b. Hydraulics

1. Processes of Measurement

Wassermessung mit scharfkantigen Ueberfallwehren.* (Water Measurement with Sharp-Edged Overflow Weirs.) Th. Rehbock. Ver. deu. Ing. June 15, '29.

2. Physical Hydraulics

Laboratory Methods of Research in Hydraulics.* L. U. Malz. June 14, '29.

A Review of Flow in Pipes and Channels.* S. J. Davies and C. M. White. Eng. Serial beginning July 19, '29.

Le Moulinet Idrac pour l'Enregistrement des Courants Marins et Fluviaux.* (The Idrac Current-Meter for Recording Marine and River Currents.) T. Teste. Gen. Civ. June 22, '29.

Neuzeitliche Venturi-Wassermessanlagen.* (Modern Venturi Water Metering Plants.) G. Eggers. Gas und Wasser. Apr. 19, '29.

Die Durchflusszahlen von Normaldüsen und Normalstaurändern für Rohrdurchmesser von 100 bis 1 000 mm.* (Discharge Coefficients of Standard Nozzles and Orifices for Pipe Diameters of 100 to 1 000 mm.) M. Jakob and Fr. Kretzschmer. Ver. deu. Ing. June 29, '29.

3. Industrial Hydraulics

Bright Future Forecast in Development of Venturi Meter.* Ralph L. Parshall. Hydraulic Eng. June, '29.

High-Head Power Plant of 120 000-Hp. Capacity Nearing Completion in Scotland.* Eng. N. R. July 4, '29.

Power Consumption Increase in Ontario.* Can. Engr. July 16, '29.

Power a Byproduct from City Water Supply.* Power July 16, '29.

4. Dams.

Volle Strebenmauer und Pfeiler-Strebenmauer.* (Gravity and Butressed Retaining Walls.) Paul Ziegler. Schw. Bauz. June 29, '29.

C. Materials of Construction and General Process

a. Lime, Cement, Mortar, Concrete, Brick, Bitumen, Timber, Gravel, etc.

Structural Timber.* J. B. Alexander. Eng. Inst. Can. June, '29.

Resistance of Concrete to Sea Water. H. E. Squire. (Paper read before Am. Concrete Inst.) Can. Engr. June 4, '29; Engr. June 21, '29.

Central Mixing Plants.* West. Constr. N. June 10, '29.

Materials in Concrete Construction. J. W. Kelly. (Paper read before Nat'l Crushed Stone Assoc.) Can. Engr. July 16, '29.

Versuche über die Schubfestigkeit von Holz.* (Tests of the Shearing Strength of Wood.) E. Gaber. Ver. deu. Ing. June 29, '29.

b. Metals

Work-Softening and a Theory of Inter-Crystalline Cohesion.* F. Hargreaves. (Paper read before Inst. of Metals, London.) Eng. June 14, '29.

Functions of Steel Plant Metallurgy. R. E. Sherlock. (Paper read before Am. Iron and Steel Inst.) Engr. June 14, '29.

Zugfestigkeit und Härte bei Metallen.* (Tensile Strength and Hardness in Metals.) O. Schwarz. Ver. deu. Ing. June 8, '29.

c. Pneumatics.

Illinois Central Shows Value of Timber Treatment.* A. F. Blaess. (Abstract of paper read before Am. Wood Preserver's Assoc.) Ry. Eng. & Main. June, '29.

Six Methods of Preventing Corrosion of Tanks and Underground Pipes. (Report read before Am. Ry. Eng. Assoc.) Ry. Eng. & Main. June, '29.

Painting Decoration on Concrete.* W. E. Hart. Conc. June, '29.

How to Remove Stains from Concrete. Conc. June, '29.

Waterproofing Concrete Structures. H. R. Lordly. Can. Engr. June 4, '29.

Korrosion und Metallschutz im Gaswerksbetrieb. (Corrosion and Metal Protection in Gas-works Operation.) Maass. Gas und Wasser. June 8, '29.

Neuartige Schutzvorrichtung für eiserne Brücken gegen Lokomotivrauchgase.* (Novel Device for Protecting Iron Bridges from Locomotive Flue Gases.) J. Kuhnke. Z. d. Bauver. June 12, '29.

f. Rock Excavation, Mining, Rock Removal

Large-Volume Earth-Handling Equipment in Germany.* Th. Krauth. Eng. N. R. July 18, '29.

g. Execution of Works, Specifications

Die Beanspruchung wagerechter Versteifungsringe bei runden Bauwerken.* (Stresses in Horizontal Stiffening Rings in Circular Structures.) Robert Kado. Z. d. Bauver. June 26, '29.

2. Of Concrete

Concrete Trestle Construction with Precast Piles and Slabs.* D. B. Packard. (Paper read before North Carolina Section, Am. Soc. C. E.) Eng. & Contr. May, '29.

Controlling the Measurement of Materials on Small Concrete Jobs.* A. S. Douglass. Eng. & Contr. May, '29.

4. Of Metal

Erecting Buildings by Welding Process.* J. F. Lincoln. (Am. Weld. Soc.) Can. Engr. June 25, '29.

Simultaneous Steel Erection and Basement Excavation on 40-Story Building.* W. S. Wolfe. Eng. N. R. July 4, '29.

Provisions of Welding Society Code for Structural Welding. Eng. N. R. July 18, '29.

Röntgenverfahren zur räumlichen Ausmessung von Fehlstellen in Werkstoffen.* (Roentgen Process for Spatial Measurement of Flows in Materials.) C. Kantner and A. Herr. Ver. deu. Ing. June 15, '29.

Geschweisste Rohrkonstruktionen.* (Welded Tube-Structures.) A. Hilpert and O. Bondy. Ver. deu. Ing. June 15, '29.

5. Of Reinforced Concrete

Eisenbeton-Schleuderrohre Bauart Vianini.* (Viviani Type Centrifugal Reinforced-Concrete Pipe.) M. Ros. Schw. Bauz. June 22, '29.

h. Foundations, Bridge Piers, and Abutments

Supporting Foundations Exposed During Nassau St. Subway Construction.* Lazarus White. Eng. N. R. June 27, '29.

The Righting of a Foundation Caisson for the Poughkeepsie Suspension Bridge, N. Y.* Frank W. Skinner. Eng. July 19, '29.

j. Piles and Pile-driving

Improved Asphalt Treatment for Concrete Piles in Sea Water.* G. F. Nicholson. Eng. N. R. July 18, '29.

k. Tunnels and Tunneling-Shield

The Cascade Tunnel: Great Northern Railway, U. S. A.* Engr. Serial beginning June 14, '29.

Select Site for Vehicular Tube Under Narrows at New York.* Eng. N. R. June 20, '29.

l. Construction Machinery and Tools—Drainage

Die wichtigsten Ergebnisse der Versuche mit Betonmischmaschinen.* (The Most Important Results of the Tests with Concrete Mixtures.) Otto Graf. Ver. deu. Ing. June 8, '29.

Leistungsversuche an Betonmischmaschinen.* (Efficiency Tests of Concrete Mixers.) Georg Garbotz. Ver. deu. Ing. June 8, '29.

D. Highways

c. Construction

Surface Repairs and Treatment of Asphaltic and Tar Penetration Surfaces. George E. Hamlin. (Paper read before Highway Officials of N. Atlantic States.) R. & S. May, '29.

Ruling Grades and Curves Between Controlling Points. Samuel Eckels. (Paper read before Highway Officials of N. Atlantic States.) R. & S. May, '29.

Basic Principles and Problems of Road Builders. E. O. Hathaway. (Paper read before County Commrs. Assoc. of N. Dakota.) R. & S. May, '29.

Sheet Concrete in Erie County, N. Y.* George C. Diehl. R. & S. May, '29.

How to Secure Better Bituminous Macadam.* William J. Dougherty. Mun. N. & W. W. May, '29.

Old Brick Pavements Relaid in Jacksonville.* W. E. Sheddan. Mun. N. & W. W. May, '29.

Highway Engineering in the Philippines.* Chas. G. Gabelman. Mil. Engr. May–June, '29.

Low-Cost Type Roads in Caddo Parish, Louisiana.* J. T. Bullen. Public W. June, '29.

Building a Concrete Pavement 10 000 Feet Above Sea Level.* Conc. June, '29.

Emulsified Asphalt for Road Work.* C. H. Thomas. (Abstract of paper read before League of Calif. Municipalities.) Public W. June, '29.

Imperial Valley Highway, California.* Amos H. Potts. West. Constr. N. June 10, '29.

d. Maintenance

Road Maintenance in Alameda County.* C. H. Thomas. Public W. June, '29.

Small Bridge and Culvert Problems. J. H. Dennis. Can. Engr. June 4, '29.

Some Road and Other Schemes at Swansea.* Robert Hudson. (Paper read before Inst. of Mun. & County Engrs.) Inst. Mun. & Co. Engrs. June 11, '29.

Premixed Oil and Aggregate for Highway Surfacing.* Eng. N. R. June 20, '29.

Influence of Flexible Bases Upon Pavement Costs and Maintenance. Chris. P. Jensen. (From paper read before Asphalt Pav. Conference.) West. Constr. N. June 25, '29.

Road Oil-Heating Plant for Los Angeles County.* W. W. Shelby. Eng. N. R. July 18, '29.

g. Machinery and Tools.

Bucket Loaders and Belt Conveyors on Road Job.* J. A. Gurney. R. & S. May, '29.

Care and Operation of Road Maintenance Equipment. J. F. Coleman. Public W. June, '29.

h. Vehicles, Automobiles, Traffic

A Proposed Traffic Plan.* Mun. N. & W. W. May, '29.

The Effect of Recent Mix Design and Control Upon Field Concrete.* Clifford E. Foster. (Paper read before Univ. of Michigan.) R. & S. May, '29.

Delaware River Bridge Traffic Exceeds Expectations.* Joseph K. Costello. Eng. N. R. July 18, '29.

E. Bridges, Viaducts and Arches

b. Load Resistance

Stabilizing a Movable Bridge Abutment.* M. M. O'Shaughnessy. Eng. & Contr. May, '29.

Champlain Bridge Over Ottawa River.* Alan K. Hay. Can. Engr. June 4, '29.

The Reconstruction of the Land Spans of Saltash Bridge.* Engr. June 21, '29.

Nouvelles Instructions Francaises pour le Calcul des Ponts en Beton Arme et Metalliques.* (New French Instructions for the Design of Reinforced Concrete and Metal Bridges.) Assoc. Ing. Gand. Pt. 1, '29.
Skizzenwettbewerb für eine Rheinbrücke bei Speyer. (Sketch Competition for a Rhine Bridge at Speyer.) Ellerbeck. Z. d. Bauver. May 29, '29.

d. Concrete and Reinforced Concrete Bridges and Viaducts

Construction of a Small Reinforced-Concrete Bridge.* Charles A. French. Mun. N. & W. W. May, '29.
Form for Bridge Deck Supported without Falsework.* M. Hirschthal. Eng. & Contr. May, '29.
Building Design Applied to a Boulevard Viaduct.* Eng. N. R. June 20, '29.
Winter Construction of Concrete Bridge, Springfield, Mo.* William Judson Gray. Eng. N. R. June 20, '29.
Some Features of Two Concrete Arch Bridges in Berks County, Pa.* L. F. Christman. Eng. N. R. July 4, '29.
Lackawanna Builds Two Concrete Bridges with Unusual Span Lengths.* M. Hirschthal. Ry. Age, July 13, '29.
Le Pont Butin sur le Rhone à Genève.* (The Butin Bridge Over the Rhone at Geneva.) Edouard Lacroix. Schw. Bauz. June 8, '29.
Nouvelles Instructions Francaises pour le Calcul des Ponts en Beton Arme et Metalliques.* (New French Instructions for the Design of Reinforced Concrete and Metal Bridges.) Assoc. Ing. Gand. Pt. 1, '29.
Die neue Strassenbrücke bei Schwedt über die Oder.* (The New Highway Bridge at Schwedt Over the Oder.) A. Freund. Zeit. Bau. Serial beginning May, '29.
Wirtschaftlichere Ausbildung der Widerlager von Balkenbrücken durch Verbindung mit dem Ueberbau.* (Economical Development of Abutments of Girder Bridges by Connection to the Superstructure.) H. Craemer. Z. d. Bauver. June 5, '29.

f. Suspension Bridges, Transfer Bridges

An Eyebar Suspension Span for the Ohio River.* Wilson T. Ballard. Eng. N. R. June 20, '29.

h. Computation, Tests, etc.

Impact in Highway Bridges.* Hubert A. Mackrill. Inst. Mun. & Co. Engrs. June 11, '29.
Les Efforts Dynamiques dans les Ponts-Rails. Expériences du Bridge Stress Committee britannique.* (Dynamic Stresses in Bridge Rails. Experiments of the British Bridge Stress Committee.) P. Caufourier. Gen. Civ. Serial beginning June 15, '29.

F. Inland Waters and Waterways

c. Regulation of Waterways, Volumes of Discharge, Freshets, Floods, Soundings

The Development of the Mongaup River.* William F. Uhl. (Paper read before Boston Soc. of Civil Engrs.) Bost. Soc. C. E. May, '29.

d. Diverting Dams, Locks, Lifts, Elevators, Inclined Planes

Repair Work at Lock Number 4 Ohio River.* Jarvis J. Bain. Mil. Engr. May–June, '29.
Note sur l'Electrification des Crics de Manoeuvre avec Commande Automatique des Portes et des Ventelles de l'Ecluse Double du Moulin-Brule sur le Canal de Sainte-Quentin.* (Note on the Electrification of Operating Jacks with Automatic Control of Gates and Valves on the Moulin-Brule Double Lock on Saint Quentin Canal.) L. Durringer. Ann. T. P. Belg. June, '29.

g. Consolidation of Banks, Leakage, Maintenance of Channel

Methods of Protecting River Banks from Erosion. (Report presented to Am. Ry. Eng. Assoc.) Eng. & Contr. May, '29.
An Appraisal of Draglines for Mississippi Levee Work.* J. C. French. Eng. N. R. June 20, '29.

G. Maritime Works

c. Vessels and Maritime Navigation, Lighthouses, Buoys, Various Signals

Sea Trials of Italian Destroyers.* F. Dondona (Paper read before Inst. Naval Archt.) Eng. June 28, '29.

e. Navigation Locks.

Die neue Schleuse in Ymuiden.* (The New Lock in Ymuiden.) C. T. C. Heyning. Ver. deu. Ing. June 1, '29.

g. Dredges and Dredging, Force Pumps, Refloating and Removing Wrecks, Ice-breakers

United States Pipe-line Dredge *Gamma*.* H. S. Gladfelter Mil. Engr. May–June, '29.
The Sinking and Salvaging of the *Navesink*.* Frank W. Gano. Mil. Engr. May–June, '29.

i. Harbors

Diverting the Brazos River to Improve Freeport Harbor.* Eng. N. R. June 20, '29.

j. Dockyard Machinery and Shipyards, Drydocks

The Navy Yard Dry Dock No. 3, Philadelphia, U. S. A.* Brysson Cunningham. Eng. June 28, '29.

H. Railroads. Street and Interurban Railways. Automobiles. Aeronautics

a. Railroads

1. General Articles

The Western Pacific Dresses Up.* Ry. Age June 22, '29.

Difficult Tunnel and Bridge Work on French Mountain Railway.* Eng. N. R. July 4, '29.

La Voie Ferrée. Problèmes d'Organisation.* (The Railroad. Organization Problems.) R. Campus. Assoc. Ing. Gand. Pt. 1, '29.

Ligne Complémentaire de la Grande Ceinture de Paris entre Bobigny et Sucy-Bonneuil.* (The Complementary Line of the Paris Great Belt-Line between Bobigny and Sucy-Bonneuil.) Bernard and Jacquey. Rev. Gen. June, '29.

Der Bau der Semmeringbahn- ein bedeutsamer Markstein in der Entwicklung des Eisenbahnwesens. (The Construction of the Semmering Road—An Important Landmark in the Development of Railroads.) Leopold Oerley. Oest. Ing. Arch. Ver. June 21, '29.

4. Track

Soft Bottom Calls for Ingenuity in Bridge Renewal.* Ry. Eng. & Main. June, '29.

5. Signals and Safety Apparatus

Railway Train Signal Practice.* P. M. Gault. A. I. E. E. June, '29.

Lackawanna Modernizes Signal System for Automatic Train Control.* J. E. Saunders. Ry. Age June 29, '29.

Report on the Power-Brake Investigation.* (Mech. Div. Am. Ry. Assoc.) Ry. Age July 6, '29.

Report on Brakes and Brake Equipment.* (Mech. Div., Am. Ry. Assoc.) Ry. Age July 6, '29.

Big Four Improves Operation by Remote Control.* Ry Age July 20, '29.

6. Rolling Stock (Locomotives, Cars) Fuel

Rail Motors.* E. Wanamaker. (Paper read before Western Railway Club.) West. Ry. Club Mar., '29.

Setting the Pace in Designing and Equipping Camp Cars.* Ry. Eng. & Main. June, '29.

Santa Fe Builds for Better Locomotive Maintenance.* Ry. Age June 22, '29.

Mikado Type Locomotive for the Georgia Northern.* Ry. Age June 29, '29.

Locomotive Performance.* E. C. Poultney. Engr. Serial beginning July 5, '29.

Distillate Rail Cars on the Union Pacific. A. H. Fetters. (Paper read before Am. Ry. Assoc. Ry. Age July 6, '29.

Report on Electric Rolling Stock.* (Mech. Div. Am. Ry. Assoc.) Ry. Age July 6, '29.

Locomotive and Car Lighting. (Mech. Div. Am. Ry. Assoc.) Ry. Age July 6, '29.

Report on Locomotive Design and Construction.* (Mech. Div. Am. Ry. Assoc.) Ry. Age July 6, '29.

Utilization of Locomotives and Conservation of Fuel.* (Mech. Div. Am. Ry. Assoc.) Ry. Age July 6, '29.

Report on Coupler and Draft Gears.* (Mech. Div. Am. Ry. Assoc.) Ry. Age July 6, '29.

Report of Committee on Tank Cars. (Mech. Div. Am. Ry. Assoc.) Ry. Age July 6, '29.

Report of Committee on Loading Rules.* (Mech. Div. Am. Ry. Assoc.) Ry. Age July 6, '29.

Report of Committee on Car Construction.* (Mech. Div., Am. Ry. Assoc.) Ry. Age July 6, '29.

Heavier Car Loading Needed. M. J. Gormley. (Mech. Div., Am. Ry. Assoc.) Ry. Age July 6, '29.

Lubrication of Cars and Locomotives.* (Mech. Div., Am. Ry. Assoc.) Ry. Age July 6, '29.

Report of Committee on Wheels.* (Mech. Div., Am. Ry. Assoc.) Ry. Age July 6, '29.

Report on Specifications and Tests for Materials.* (Mech. Div., Am. Ry. Assoc.) Ry. Age July 6, '29.

The Design of Fuel-Oil Stations Presents Many Problems.* H. L. Kauffman. Ry. Age July 20, '29.

Handling Perishables by Rail. (From papers read before Am. Soc. Refrigerating Engrs.) Ry. Age July 20, '29.

Note sur l'Amélioration de la Surchauffe dans les Locomotives. Essais Effectues à la Compagnie des Chemins de Fer de Paris à Lyon et à la Mediterranée.* (Note on the Improvement of Superheating in Locomotives. Tests Made by the Paris-Lyons-Mediterranean Railroad Company.) Ch. Bourrié. Rev. Gen. June, '29.

7. Uses of Electricity

An Electrified Railway Substation of the Pennsylvania Railroad.* J. V. B. Duer. A. I. E. E. June, '29.

Development of Electric on the Pennsylvania.* H. A. Dahl. Ry. Age July 6, '29.

How the Great Northern Carried Communication Circuits Through Electrified Territory.* J. C. Rankine. Ry. Age July 13, '29.

Fortschritte im Bau elektrischer Lokomotiven.* (Progress in Construction of Electric Locomotives.) K. Sachs. Ver. deu. Ing. June 29, '29.

8. Stations, Terminals, Engine Houses, Shops

Design and Construction of Mobile Terminal.* William L. Sibert. Mil. Engr. May–June, '29.

New England has Efficient Stores System.* E. S. Montgomery and E. W. Sadler. Ry. Age Pt. 2, June 22, '29.

C. N. R. Montreal Terminals Project. Can. Engr. June 25, '29.

Enlarged Freight Yard and Engine Terminal for Norfolk & Western Railway.* Eng. N. R. June 27, '29.

Report on Design of Shops and Engine Terminals. (Mech. Div., Am. Ry. Assoc.) Ry. Age July 6, '29.

Report of Sub-Committee on Apprentices. (Mech. Div., Am. Ry. Assoc.) Ry. Age July 6, '29.

Handling 11 000 Trains on Time.* Ry. Age July 13, '29.

Magasin Général des Matières de Saint Pierre-des-Corps.* (Saint-Pierre-des-Corps General Materials Warehouse.) Gely. Rev. Gen. June, '29.

9. Technical and Commercial Use

A Constructive Progrem for Motor Transport Regulation.* R. W. Harbeson. Ry. Age, Pt. 2, June 22, '29.

Insuring Safety in Operation.* R. J. Littlefield. Ry. Age, Pt. 2, June 22, '29.
Motor Vehicles Cut Operating Losses.* Ry. Age, Pt. 2, June 22, '29.
Southern Pacific Involved in Motor Coach Merger.* Ry. Age, Pt. 2, June 22, '29.

10. Accidents

Analysis of Grade Crossing Accidents Leads to Better Understanding.* H. L. Engelhardt. Ry. Age, June 22, '29.
Heavy Repairs Required after Fire in Memphis Bridge.* Ry. Age, June 29, '29.

b. Special Railroads

1. Rack Railroads

Spezifischer Energieverbrauch der Bergbahnen. (Specific Power Consumption of Mountain Railroads.) W. Kummer. Schw. Bauz. June 15, '29.

x. Miscellaneous

Le Port Industrial de Venise. Projet de Chemin de Fer Souterrain entre Mestre et le Lido.* (The Industrial Port of Venice. Plan for an Underground Railroad between Mestre and the Lido.) Giulio Tian. Gen. Civ. June 29, '29.

f. Aeronautics

1. General Articles

Radio Developments Applied to Aircraft.* J. H. Dellinger and H. Diamond. Mech. Eng. July, '29.
The T. A. T. Air Rail Service.* Ry. Age July 6, '29.

4. Aerodromes and Landing Fields

The Need for Permanent Improvements at Airports.* E. K. Smith. (Paper read before First Annual Airport Convention.) Conc. June, '29.
Fundamentals and Certain Details of Airport Design and Construction.* Philip R. Love. Mech. Eng. June, '29.

I. Municipal Water-Works. Agricultural Engineering. Irrigation

Developing a Surface Water Supply.* Arthur L. Reeder. Public W. June, '29.
Another Big Stride in San Francisco's Program for Added Water Supply.* O. G. Goldman. Hydraulic Eng. June, '29.
Lake Waco Water Supply Project, Waco, Texas.* West. Constr. N. June 10, '29.
Agricultural Value of Nile Silt Held Fallacious.* E. McKenzie Taylor. Eng. N. R. June 20, '29.

b. Hydrology, Water Resources

Emergency Water Supply in War Time.* H. B. Allen Sickel. Mil. Engr. May–June, '29.
Developing Ground Water Supply at Newton.* Public W. June, '29.
Yankton Abandons Artesian Wells for Missouri River.* F. G. Brueckmann. Eng. N. R. June 20, '29.
La Prise d'Eau de la Centrale Port-du-Rhin de la Société "Electricité de Strasbourg."* (The Water Supply of the Port-du-Rhin Central Station of the "Electricite du Strasbourg" Company.) Gen. Civ. June 15, '29.
Die Grund- und Quellwasservorräte des südbayerischen Tertiärgebietes.* (Groundwater and Springwater Supplies of the South Bavarian Tertiary Region.) Lothar Reuter. Gas und Wasser. June 15, '29.

c. Dams and Reservoirs

Greater Need is Felt for Reservoirs of Improved Type.* Hydraulic Eng. June, '29.
San Gabriel Dam for Los Angeles County Flood Control District, California.* E. C. Eaton. West. Constr. N. June 10, '29.
Spillway Provisions for Dwinnell Reservoir.* John A. Beemer. West. Constr. N. June 25, '29.
New 20-M. G. Clear-Water Reservoir for Detroit Water-Works.* Eugene A. Hardin. Eng. N. R. July 4, '29.
Sluice Gates for the Sarda River Irrigation Scheme.* Engr. July 12, '29.
Zur Erhöhung der Nilstaumauer bei Assuan.* (On the Heightening of the Nile Dam at Assuan.) Schw. Bauz. June 15, '29.

d. Analysis and Purification of Water

The Identification and the Control of Algae. L. B. Mangun. (Abstract of paper read before Kansas W. W. Assoc.) Mun. N. & W. W. May, '29.
The Activated Carbons and Their Use in Removing Objectionable Tastes and Odors from Water.* John R. Baylis. Am. W. W. Assoc. June, '29.
Chlorination of Pipe Lines Under Construction. John R. McClintock. Am. W. W. Assoc. June, '29.
The Removal of Iron from Hard Ground Waters.* R. L. McNamee. Am. W. W. Assoc. June, '29.
Crenothrix in Ground Water Supplies. Kenneth W. Brown. Am. W. W. Assoc. June, '29.
Bacteria on Leather Washers. F. E. Greer and L. C. Kells. Can. Engr. July 16, '29.
Pollution of Drinking Water. Scotland G. Highland. Can. Engr. July 16, '29.
Chemische Wasserstatistik der deutschen Gemeinden.* (Chemical Water Statistics of the German Community.) K. Thumm. Gas und Wasser. Serial beginning April 13, '29.
Filter aus aktiver Kohle zur Verbesserung des Geschmacks von gechlortem Trinkwasser. (Activated Charcoal Filter for Improving the Taste of Chlorinated Drinking Water.) Imhoff and Sierp. Gas und Wasser. May 18, '29.
Verbesserung des Geruchs und Geschmacks von Trinkwasser. (Improving the Odor and Taste of Drinking Water.) F. Sierp. Tech. Gemein. Serial beginning June 5, '29.
Verhalten von Zink- und Blei-Wasserleitungsröhren gegenüber Wasser- und Salzlösungen.* (Behavior of Zinc and Lead Water Pipes Toward Aqueous and Salt Solutions.) Ernst Frister. Tech. Gemein. June 5, '29.

e. Distribution of Water

Construction of the Wachusett Coldbrook Water Supply Tunnel.* Alfred Gargaro and Frank E. Fahlquist. Public W. June, '29.
Increased Demand for Concrete Pipe Indicates Rich New Field.* Fred C. Scobey. Hydraulic Eng. June, '29.
Some Notes on Pipe Practice in Europe. R. H. Keays. Am. W. W. Assoc. June, '29.
Cleaning Water Mains, Results and Costs.* Thomas J. Skinker. Am. W. W. Assoc. June, '29.
The Construction of the Distribution System. C. L. Ehrhart. Am. W. W. Assoc. June, '29.
Pitometer Surveys. Cyrus R. Bird. Am. W. W. Assoc. June, '29.
Deep Well Pump Installation, Brampton.* F. C. McClory. Can. Engr. June 25, '29.
Installation of Valves and Hydrants. C. S. Howard. (Paper read before Iowa W. W. Conference.) Can. Engr. June 25, '29.
Spun Concrete Pipe Conveys Water Supply Under 145-Ft. Head.* H. Hawgood. Eng. N. R. June 27, '29.
Die Wasserversorgung der Stadt Köln und das neue Wasserwerk bei Weiler.* (The Water Supply of the City of Cologne and the New Waterworks at Weiler.) Prenger. Gas und Wasser. Apr. 19, '29.

f. Drainage of Land

Extensive Land Drainage Work in Arkansas.* H. W. English and Albert S. Fry. Eng. N. R. June 27, '29.
Cairo Main Drainage Scheme—The Amiria Pumping Station.* Engr. July 5, '29.
Reconstructing a Drainage-Ditch System.* H. W. English and Albert S. Fry. Eng. N. R. July 18, '29.

J. Sewerage. Sewage and Refuse Disposal

a. Sewers and Drains

Overloading Sanitary Sewers. Alexander Blair. (From paper read before N. J. Sewage Works Assoc.) Public W. June, '29; Mun. N. & W. W. May, '29.
Underdrained Sewers at Rye, N. Y.* Henry W. Taylor. Public W. June, '29.
Construction Methods and Form Details on New Sewer and Treatment Plant at Springfield, Ill.* Conc. June, '29.
Llansamlet Pumping Station, Swansea.* M. E. Habershon. (Paper read before Inst. of Mun. & County Engrs.) Inst. Mun. & Co. Engrs. June 11, '29.
Experience with Flat Sewer Grades. Andrew M. Jensen. (Paper read before Calif. Sewage Works Assoc.) West Constr. N. June 25, '29.

b. Sewage Disposal, Purification

Activation of Sludge by Mechanical Aeration.* W. DeWitt Vosbury and Philip B. Streander. Mun. N. & W. W. May, '29.
Sewage Treatment at Flint. Public W. June, '29.
Sludge Filter Design and Operation. H. C. H. Shenton. Can. Engr. June 4, '29.
Pumping Sewage.* Herbert Paterson. (Paper read before Calif. Sewage Works Assoc.) West. Constr. N. June 10, '29.
Die Kläranlage de Stadt Chemnitz.* (The Chemnitz Municipal Clarifying Plant.) Hermann Roch. Gesund. Ing. May 25, '29.
Neuzeitliche Abwässereinigung unter besonderer Berücksichtigung der Gasgewinnung.* (Modern Sewage Purification with Special Attention to Gas Production.) Blech. Gas und Wasser. June 8, '29.
Der Neubau der Nachkläranlage der Stadt Blankenburg am Harz.* (Reconstruction of the After-Clarifying Plant of the City of Blankenburg on the Harz.) Weidlich. Tech Gemein. June 20, '29.

c. Refuse Disposal

Die Reinigung der Abwässer aus Rübenzuckerfabriken.* (Purification of Beet Sugar Factory Waste Water.) M. Grevemeyer. Gesund. Ing. June 22, '29.

L. Electricity

b. Distribution and Transmission of Electricity

1. Power Plants
Die 100 at-Anlage des Grosskraftwerkes Mannheim.* (The 100-Atmospheres Equipment of the Mannheim Superpower Plant.) F. Marguerre. Ver. deu. Ing. Serial beginning June 29, '29.
2. Long-Distance Transmission of Energy
Interrupting Equipment for Alternating Current High Power Circuits.* L. B. Chubbuck. Eng. Inst. Can. June, '29.
5. Transformers and Converters
Automatic Transformer Substations of the Edison Electric Illuminating Company of Boston.* William W. Edson. A. I. E. E. June, '29.

c. Electric Lighting

Lighting.* Clark Baker. West. Constr. N. June 25, '29

d. Mechanical Uses of Electricity

3. Welding
Structural Steel Welding.* F. T. Llewellyn. (Paper read before Engrs. Soc. of Western Pa.) Engr. Soc. W. Pa. Apr., '29.

Arc Welding of Steel Buildings and Bridges.* Frank P. McKibben. (Paper read before Engrs. Soc. of Western Pa.) Engr. Soc. W. Pa. Apr., '29.
Arc Welding of Steel Buildings and Bridges.* Frank P. McKibben. (Abstract of paper read before Am. Inst. of Elec. Engrs.) Eng. & Contr. May, '29.
Oxy-Acetylene Welding of Steel.* S. W. Miller. Engrs.' Soc. W. Pa. May, '29.
Standard Voltage A-C. Network.* John Oram. A. I. E. E. June, '29.
Erecting Buildings by Welding Process.* J. F. Lincoln. Can. Engr. June 25, '29.
Provisions of Welding Society Code for Structural Welding. Eng. N. R. July 18, '29.

e. Electrochemistry and Electrometallurgy

Iron and Steel Melting in the Electric Furnace.* (Paper read before Western Soc. of Engrs.) Delton T. Waby. West. Soc. Engrs. June, '29.
The Tacoma Plant of the Hooker Electrochemical Company.* West. Constr. N. June 25, '29.
Great Western Electro-Chemical Company Plant, Pittsburg, California.* West. Constr. N. June 25, '29.

f. Signals and Communication

Electrical Wave Analyzers for Power and Telephone Systems.* R. G. McCurdy and P. W. Blye. A. I. E. E. June, '29.

M. Architecture

a. Educational, Government and Scientific Buildings

Der konstruktive Aufbau der Stadthalle in Magdeburg.* (Structural Execution of the Magdeburg City Hall.) H. Wittig. Z. d. Bauver. June 19, '29.
Die neue Stadthalle in Magdeburg.* (The New City Hall in Magdeburg.) W. C. Behrendt. Z. d. Bauver. June 19, '29.

c. Residences, Hotels

Stahlhäuser und Stahlhaus-Siedlungen bei Düsseldorf.* (Steel Houses and Steel-House Settlements at Dusseldorf.) Richard Batz. Z. d. Bauver. June 26, '29.

g. Other Buildings

Le Nouveau Casino Municipal de Dinard avec Piscine d'Eau de Mer Filtrée et Chauffée.* (The New Municipal Casino of Dinard with Swimming-Pool of Filtered and Heated Sea-water.) M.-G. Breton. Gen. Civ. June 15, '29.

h. Roofs, Domes, Steel Framing

Design of Capitol Dome at Olympia, Wash.* David C. Coyle. Eng. N. R. July 18, '29.

O. Administration. Legislation. Economics. Statistics

b. Economic Questions of a General Character, Valuations, Etc.

Cost-Plus Percentage Construction Contract. (Report presented to Am. Ry. Eng. Assoc.) Eng. & Contr. May, '29.

d. Storage Buildings

2. Routes and Roads

Methods of Financing Highway Construction. Charles M. Upham. (Paper read before Am. Road Bldrs. Assoc.) R. & S. May, '29.
Report on Prices for Labor and Materials.* (Mech. Div. Am. Ry. Assoc.) Ry. Age July 6, '29.

e. Legislation—Question Concerning Wages and Working Conditions

Wage Incentives for Direct Labor.* Charles W. Lytle. Mech. Eng. July, '29.

Q. Surveying and Geodesy

The Northern Luzon Triangulation.* Elliott B. Roberts. Bost. Soc. C. E. May, '29.
Military Maps and Their Reproduction.* Dabney O. Elliott. Mil Engr. May–June, '29.
Le Nivellement.* (Leveling.) Maurice Alliaume. Ann. T. P. Belg. June, '29.

R. Landscape Engineering

The Design of Colonial Places in Virginia.* Arthur A. Shurtleff. Land. Arch. Apr., '29.
A Semi-Formal Park in Oklahoma.* George F. Ingalls. Land. Arch. Apr., '29.

S. City Planning

The Niagara Falls Situation. J. Horace McFarland. Land. Arch. Apr., '29.
Local Geography as a Basis for Teaching City Planning.* Donald S. Gates. City Plan. Apr., '29.
City Planning in Portland, Oregon.* Howard K. Menhinick. City Plan. Apr., '29.
A New Idea in Special Assessments. Charles Herrick. City Plan. Apr., '29.

Brief Survey of City and Regional Planning in the United States, 1928.* Theodora Kimball Hubbard. City Plan. Apr., '29.
Municipal Undertakings and Administration at Consett.* T. Hutton. (Paper read before Inst. of Mun. & County Engrs.) Inst. Mun. & Co. Engrs. June 11, '29.
Engineers' Town Planning Attitude. A. G. Dalzell. (Paper read before Town Plan. Inst. Can.) Can. Engr. June 25, '29.
Recent City and Regional Planning in New York State. George B. Ford. Eng. N. R. July 18, '29.
Aus Rendsburg und Hagen. Bebauungspläne von Hermann Jansen.* (From Rendsburg and Hagen. Building Plans by Hermann Jansen.) Karl Weishaupt. Z. d. Bauver. May 29, '29.
Von der Werkbund-Siedlung "Neubühl" in Zürich-Wollishofen.* (The "Neubuehl" Workmen's Union Settlement in Wollishofen, Zurich.) Schw. Bauz. June 29, '29.
Reihenbau und Zeilenbau.* (Continuous Building and Ranked Building.) Heiligenthal. Z. d. Bauver. June 12, '29.

T. Oil and Oil Engineering

Electrification of Oil Pipe Lines in the Southwest.* D. H. Levy. A. I. E. E. June, '29.

Engineering Societies Employment Service

The Engineering Societies Employment Service is under the joint management of the National Societies of Civil, Mining, Mechanical, and Electrical Engineers. A Chicago office is maintained in co-operation with the Western Society of Engineers, and a San Francisco office, in co-operation with the Engineers' Club of San Francisco and the California Section of the American Chemical Society. The Service is available only to the several memberships and is maintained by contributions from the Societies and their individual members who are directly benefited.

Officers.—Eastern Office, 31 West 39th Street, New York, N. Y., Walter V. Brown, Manager; Chicago Office, 205 West Wacker Drive, 1216 Engineering Building, Chicago, Ill., A. Krauser, Manager; and San Francisco Office, 57 Post Street, Room 715, San Francisco, Calif., Newton D. Cook, Manager.

Men Available.—Under this heading, brief announcements will be published without charge. These announcements will not be repeated, except on request received after an interval of one month. Notices for *Proceedings* should be addressed to Employment Service, 31 West 39th Street, New York, N. Y., and should be received prior to the first of the month.

Opportunities.—A Bulletin of engineering positions available is published weekly and may be obtained by members of the Societies concerned at a subscription rate of $3 per quarter, or $10 per annum, payable in advance. Positions which are not filled promptly as a result of publication in the Bulletin, may be announced herein.

Placement Fees.—The Service is operated on a co-operative basis, whereby those benefiting contribute in accordance with the following rates: One and one-half per cent. of the first year's salary for permanent positions. Temporary positions, six months or less, 3% of the total salary received, payable monthly.

Replies to Announcements.—Replies to announcements published herein, or in the Bulletin, should be addressed to the key number indicated in each case, with two two-cent stamps attached for re-forwarding, and forwarded to the Employment Service at the address given. Replies received by the Service after the positions to which they refer have been filled, will not be forwarded.

MEN AVAILABLE

CIVIL ENGINEER, Assoc. M. Am. Soc. C. E.; married. Graduate civil engineer. Fifteen years' general experience specializing during latter years on design and construction of sewerage and water systems, including treatment works and pumping stations. Desires new connection with opportunity for growth. Available on reasonable notice. Location desired, Eastern States. A–466.

EXECUTIVE AND CIVIL ENGINEER, Assoc. M. Am. Soc. C. E., open for connection with construction company or concern manufacturing products for the construction industry; age 36; thorough educational and professional training. For the past five years vice-president and consulting engineer of construction company. Thoroughly familiar with contracting and purchasing end of business. A–515.

PUBLIC UTILITY ENGINEER, M. Am. Soc. C. E.; married. Seventeen years' experience covering design and construction, supervision of hydro-electric developments, steam plants, sub-stations, and transmission lines. Investigations, reports, and economic studies of power projects. Condemnation and damage matters. Negotiations, public relations, public speaking. Wants responsible position as executive engineer or special assistant to executive management. A–1137.

CONSULTING ENGINEER, Assoc. M. Am. Soc. C. E.; age 63; married. Expert on design and construction, dams, masonry of

all kinds, aqueducts, pipe lines, hydro-electric, domestic supply, irrigation, hydraulics generally. Examinations, estimates, bids, appraisals, reports. Foreign experience, Peru, Mexico, Santo Domingo, Sicily, Greece. A–2848.

CIVIL ENGINEER, M. Am. Soc. C. E.; with general experience of 25 years, including construction and investigations in foreign countries, direct charge of important railway and bridge construction, highways, irrigation, drainage, water supplies, valuations, design, reconnaissances and investigations for various large projects. Fluent knowledge of French. Adaptable with foreign people and conditions. B–1476.

CIVIL AND SANITARY ENGINEER, M. Am. Soc. C. E.; married. Extensive experience in engineering, design, construction; railroads, street railways, irrigation, highways, harbor improvements, sewerage, sewage disposal, water supply, hydro-electric developments. Employed in various capacities, from draftsman to chief engineer, projects costing $500 000 to $20 000 000. Good knowledge of Spanish. Atlantic, Pacific Coast, or Spanish speaking countries. B–1550.

INSTRUCTOR, Assoc. M. Am. Soc. C. E.; graduate (1919, degree, C. E.), Polytechnical University in Europe; majored in bridges; age 35; married. Since graduation, responsible charge of design, bridges, power plants, high buildings; considerable experience, statically indeterminate systems. Able theorist. Location immaterial. B–5176.

GRADUATE CIVIL ENGINEER, Assoc. M. Am. Soc. C. E.; general civil and mechanical engineering experience; also radio equipment. Could qualify for airport design or construction work. Now employed, interview solicited. Available on short notice. B–7018.

CIVIL ENGINEER, M. Am. Soc. C. E. Twenty years' experience, railroad location, highway, precise surveys, irrigation, and reinforced concrete construction. Competent to make investigations for hydro-electric development, reports and estimates on engineering work. Thoroughly conversant with Latin-America. Will accept any reasonable foreign engagement. B–7494.

PROFESSOR OF CIVIL ENGINEERING. M. Am. Soc. C. E.; Master's Degree, Cornell. Nine years' teaching; 10 years' responsible practice on sewerage projects, experimental work, pollution studies, and water supplies, also 3 years on railroads, structural, and surveying. Will consider responsible teaching, or with firm or city. B–7678.

ARCHITECTURAL DRAFTSMAN, DESIGNER, AND ENGINEER; 10 years' experience; structural steel and concrete; roof trusses; brick, stone, and wood construction; also, all working drawings, plumbing sections, etc. B–9178.

ESTIMATOR, Jun. Am. Soc. C. E.; college graduate; age 28. One year's experience on highway and sewer construction; four years' experience estimating all types of commercial and industrial buildings; also experienced in job supervision and layout. Desires change to connection offering greater possibilities. C–1.

CIVIL ENGINEER, M. Am. Soc. C. E., with experience as one of chief engineering officers of a transcontinental railroad; as manager of a short-line railroad; as assistant superintendent of a main line division; and with training in the bridge engineer's office and in the field on location, construction, and maintenance, desires to make a connection. C–2263.

RESIDENT ENGINEER, Assoc. M. Am. Soc. C. E.; Civil Engineer Graduate, University of California; age 38; single. Three years, resident engineer; charge of pumping plant and power plant construction, railroad location and construction, reinforced concrete bridge construction. U. S. Army Engineer Corps. One week's notice. C–3387.

STRUCTURAL ENGINEER, Assoc. M. Am. Soc. C. E.; age 33; married; registered professional engineer, Pennsylvania; formerly officer, Corps of Engineers, U. S. Army; engineering, arts degrees. Familiar with steel, concrete design, statically indeterminate structures, unusual footings, retaining walls, transmission line structures. Estimates, specifications, negotiations. Some sewer work, roads, underground conduits. Supervision of office work, design, drafting, surveys, and construction. C–5626.

GRADUATE CIVIL ENGINEER, M. Am. Soc. C. E. Twenty-five years' experience, design, construction, and supervision; water purification works, concrete reservoirs, elevated concrete tanks, concrete buildings, aerators, pumping stations, pipe lines, etc. Twenty years, responsible charge; seven years, contractor's superintendent; understands organization to obtain results. Desires permanent position with Consulting Engineer, Municipality, Contractor, or Industrial Company. C–5688.

GRADUATE CIVIL ENGINEER, with 10 years' broad experience in concrete, steel, and hydraulics: industrial plants, hangars, airship halls, bridges, theatres, churches, and hydro-electric developments; design, estimate, specifications, and construction; good organizer; desires responsible position preferably abroad, Europe or South America. Languages: English, French, German, Spanish, Portuguese. C–5774.

BRIDGE AND STRUCTURAL ENGINEER. Assoc. M. Am. Soc. C. E.; graduate; age 32. Ten years' design of bridges, buildings, construction, and managing executive for contractors. Now employed, desires permanent connection with good opportunity with railway, highway, contracting company, or industrial corporation. C–5803.

DESIGNER, Assoc. M. Am. Soc. C. E.; B. S. C. E. 1921; age 31; married. Six years' European education; two years, European. six years, American practice, designing reinforced concrete, structural steel structures; industrial buildings, statically indeterminate structures, reinforced concrete arches, continuous and movable bridges, including machinery. Desires responsible position, designing engineer. Four languages. Location, immaterial. C–5983.

CIVIL ENGINEER, Assoc. M. Am. Soc. C. E.; age 39. Eighteen years' experience in Latin-America on railroad, location, construction, valuation, and maintenance; also,

topographic surveys, pile and frame trestle construction, concrete construction, drainage. Very successful with traveling labor, contractors, as well as reducing cost on various jobs. Will consider sales or advertisement of railroad or construction materials in those countries. C–6139.

STRUCTURAL ENGINEER, Jun. Am. Soc. C. E.; B. S. in C. E.; age 25; single. Two years' experience in general construction and civil engineering work and one year's experience as a structural steel draftsman, interested in both bridge and structural engineering. Location, New York City. C–6186.

ARCHITECTURAL STRUCTURAL ENGINEER, Assoc. M. Am. Soc. C. E.; age 41; experienced on design and construction of steel, concrete, masonry; installation and operation of machinery. Has sold two-thirds of contracts in present position as consultant in special field. Wants regular building work. Location, for work of limited duration, anywhere; for permanent work, night's run from Boston, Mass. C–6229.

CIVIL ENGINEER, Assoc. M. Am. Soc. C. E.; age 44; married. Seventeen years, maintenance of way, section foreman, accountant, valuation engineer, etc.; three years, oil company, engineer, draftsman, etc.; ten years, building contracting, estimating; eight years of this in business for himself. Location, Pacific Coast. Erected schools, business buildings, seminaries, churches, theatres, and other commercial buildings. Acted as architect's superintendent. C–6279.

GRADUATE CIVIL ENGINEER, Jun. Am. Soc. C. E.; age 27; single. Six years' varied experience; railroad engineering, State highway department; engineer, large steel company, estimating and designing company structures; now in charge of concrete bar division. Has permanent connection, but seeks broader opportunity. C–6299.

Membership

(From July 3, to August 6, 1929)

Additions

MEMBERS		Date of Membership.
AROYAN, Hagop Harootune. Asst. Office Engr., Philadelphia Impvts., P. R. R. (Res., 40 Sunshine Rd., Upper Darby), Pa.	Assoc. M. M.	Oct. 10, 1927 July 8, 1929
ASHTON, John James. Engr., McClintic-Marshall Co., 39 Broadway, Room 1203, New York, N. Y.	Assoc. M.	July 15, 1929
AUSTIN, Herbert Ashford Robertson. Cons. Civ. and Hydr. Engr., 508 Stangenwald Bldg., Honolulu, Hawaii	Jun. Assoc. M. M.	April 17, 1917 Sept. 12, 1921 June 10, 1929
BAILEY, Thomas Ward. Div. Engr., State Highway Comm., Room 1008 Nixon Bldg., Corpus Christi, Tex.	M.	July 15, 1929
BARBER, Philip Ernest, Jr. Transitman, Mo. Pac. Lines, 204 Union Station, Houston, Tex.	Jun.	July 15, 1929
BARNES, James Newton. Draftsman, State Highway Dept., East Point, Ga.	Jun.	Mar. 11, 1929
BERG, Frank Anton. 3522 Clifton St., El Paso, Tex.	Assoc. M.	June 10, 1929
BHIROMYA, Tatt Makara. Acting Maintenance Engr., Royal State Rys., Chumpon, Siam.	Jun.	Mar. 11, 1929
BISCHMAN, Harold Willard. Chf. Insp., State Div. of Waterways (Res., 221 Mississippi Ave.), Joliet, Ill.	Jun.	June 10, 1929
BLAKELY, William Roy. Gen. Supt. and Engr., Christensen Bros. Co., Urbana, Ill.	Jun. Assoc. M.	April 20, 1925 July 15, 1929
BLANK, Albert Stein. Town Engr. and Supt. of Constr. (Res., 66 Malone Ave.), Belleville, N. J.	Assoc. M. M.	Nov. 15, 1926 July 8, 1929
BOGY, Tom Vital. City Engr., Box 398, Helena, Mont.	Assoc. M.	July 15, 1929
BRADNER, James Wood, Jr. Res. Engr., The Proctor & Gamble Mfg. Co., Haubert and Nicholson Sts., Baltimore (Res., Round Bay, Severna Park P. O.), Md.	Assoc. M.	July 15, 1929
BROCKWAY, James McCormick. Asst. Hydr. Engr., State Div. of Water Rights, 401 Public Works Bldg., Sacramento, Calif.	Jun.	Mar. 11, 1929
BRYDONE-JACK, Herbert Disbrow. Asst. Engr., Constr. Dept., C. P. Ry. Winnipeg, Man., Canada	Assoc. M.	July 15, 1929
BUENTE, Williard Harrison. Prin. Asst. Engr., The W. G. Wilkins Co. (Res., 3525 Diploma St., N. S.), Pittsburgh, Pa.	Assoc. M. M.	Aug. 9, 1920 July 15, 1929
BULGER, John Wesley. Asst. Prof., Univ. of Akron (Res., 368 Sherman St.), Akron, Ohio.	Assoc. M.	July 15, 1929
BURKE, Maxwell Follansbee. Draftsman, Los Angeles County Flood Control, Los Angeles (Res., 1601 South Fair Oaks, South Pasadena), Calif.	Jun.	April 15, 1929
CALVIN, Elmer Ben. Fredericksburg, Tex.	Jun.	July 15, 1929
CAMP, George Dashiell. Cons. Engr., Apartado Postal 1005, City of Mexico, Mexico.	Jun. Assoc. M. M.	Sept. 12, 1916 April 3, 1922 July 8, 1929
CARLTON, Ernest Wilson. Asst. Prof., Civ. Eng., Missouri School of Mines and Metallurgy (Res., 1406 Rolla St.), Rolla, Mo.	Assoc. M.	June 10, 1929
CASH, Henry. Asst. Engr., Bureau of Bldgs., Borough of Manhattan; 1026 President St., Brooklyn, N. Y.	Assoc. M. M.	Aug. 31, 1925 July 8, 1929
CHAMBERS, Bernard Isbister. Care, Lloyds Bank, Malmesbury Park, Bournemouth, England	M.	June 10, 1929
CLARK, Edgar Charles. Instr., Dept. of Mechanics, Ohio State Univ., Columbus, Ohio.	Jun.	July 15, 1929
CLOTTS, Herbert Vane. Chf. Irrig. Engr., U. S. Indian Bureau, 3103 Interior Bldg., Washington, D. C.	M.	July 15, 1929
COBURN, Charles Lyman. Asst. Designing Engr., Met. Dist. Water Supply Comm., 24 School St., Boston (Res., 390 Newtonville Ave., Newtonville), Mass.	Assoc. M.	July 15, 1929
DARRELL, George Charles. Structural Engr., Ellerbe & Co., 692 Endicott Bldg., St. Paul, Minn.	Assoc. M.	June 10, 1929
DAVEY, Thomas Farrance. Civ. Eng. Designer, Union Oil Co. (Res., 2046 Fairbourn Ave.), Los Angeles, Calif.	Assoc. M.	May 13, 1929
DAVIDSON, Alfred Harry, Jr. City Engr., City Hall, Del Rio, Tex.	Jun.	Mar. 11, 1929
DAVIS, Marvin Lee. Civ. Engr., Firestone Tire & Rubber Co. (Res., 1347 Delia Ave.), Akron, Ohio.	Assoc. M.	July 15, 1929
DENNISTON, Jesse Hempstead, 4505 West 8th St., Cincinnati, Ohio.	Assoc. M.	Mar. 11, 1929
EMBREY, Edmond Ellis. Office Engr., State Highway Dept., 460 County Records Bldg., Dallas, Texas.	Assoc. M.	June 10, 1929
FALSTAD, Gunnar. With Stevens & Wood, Inc., 20 Pine St., New York (Res., 6901 Shore Rd., Brooklyn), N. Y.	Assoc. M.	June 10, 1929
FRASUER, Ferrel Hightower. Pres., Southeastern Vibrolithic Corporation (Res., 745 Sherwood Rd., N. E.), Atlanta, Ga.	Assoc. M.	June 10, 1929
FROMHERZ, Alvin Matthew. Gen. Contr., 344 Camp St., New Orleans, La.	Assoc. M. M.	May 28, 1923 July 15, 1929
FRY, Albert Stevens. Treas., Morgan Eng. Co., 622 Goodwyn Inst. Bldg., Memphis, Tenn.	Assoc. M. M.	June 18, 1918 July 15, 1929

MEMBERS—(*Continued*)

		Date of Membership.
GALLOGLY, Ralph Fred. 3172 Glendora Ave., Cincinnati, Ohio...	Jun.	July 15, 1929
GLAESER, Frederick. Engr., Constr. Dept., Consolidated Gas Co. of New York, 4 Irving Pl., New York (Res., 239 East 25th St., Brooklyn), N. Y.	Assoc. M. M.	May 12, 1919 July 8, 1929
GRIFFIN, Wray Wallace. 49½ Pleasant St., St. Johnsbury, Vt...	Assoc. M.	June 10, 1929
HALPIN, John Francis. With N. Y. C. R., New York (Res., 7 Everett Ave., Ossining), N. Y.	Assoc. M.	July 15, 1929
HARRIS, Howard Avery, Jr. Asst. Chf. Engr., Pacific Coast Div., Public Works Eng. Corporation, San Francisco (Res., 1614 Everett St., Alameda), Calif.	Jun.	June 10, 1929
HATCH, Bernard Franklin. Asst. Engr., State Dept. of Health, Pure Oil Bldg. (Res., 3042 Woodbine Pl.), Columbus, Ohio....	Assoc. M.	Mar. 11, 1929
HEATON, Earl Oscar. Junior Hydrographic and Geodetic Engr., U. S. Coast and Geodetic Survey, Box 2512, San Francisco, Calif.	Jun. Assoc. M. M.	April 25, 1921 Dec. 15, 1924 July 8, 1929
HERSEY, Theodore Schuyler. Cons. Engr., Smith, Emery & Co., 651 Howard St., San Francisco, Calif.	Assoc. M.	July 15, 1929
HESSLER, Bernard Phillip. Vice-Pres. and Chf. Engr., Francis R. Weller, Inc. (Res., 218 S St., N. E.), Washington, D. C...	M.	July 15, 1929
HODGESON, Herbert Hardy. Topographic Engr., U. S. Geological Survey, Washington, D. C.	M.	July 15, 1929
HUBBARD, Thomas Foy. Instr., The Johns Hopkins Univ. (Res., 2916 Poplar Terrace), Baltimore, Md.	Assoc. M.	July 15, 1929
HUGERSHOFF, Reinhard. Prof. of Geodesy, High School of Forestry, Tharandt (Res., 34 Weinberg St., Dresden, N. 23), Germany.	M.	June 10, 1929
JAKOBSSON, Herman Anton. 2926 Ulloa St., San Francisco, Calif.	Assoc. M.	May 13, 1929
JAMES, Robert Trafford. Cons. Engr., Bush House, Aldwych, W. C. 2, London (Res., Brook Cottage, Brook, Godalming, Surrey), England.	Assoc. M.	June 10, 1929
JONES, Edmund Hazen. Comision Fiscal Permanente, Casilla de Correo 700, La Paz, Boliva.	Assoc. M.	June 10, 1929
KASHKIN, Constantin Nicolaevitch. Prof., Leningrad Inst. of Ways of Communications, Demidoff 1 lodg. 35, Leningrad, Union of the Socialistic Soviet Republics.	M.	June 10, 1929
KELLY, Harry Joseph. Asst. Chf. Engr., Gulf Refining Co., Box 1567, Girard Point, Philadelphia, Pa.	Assoc. M. M.	Sept. 9, 1919 July 15, 1929
KEMMAN, Arthur Sylvanus. Draftsman, Los Angeles County Flood Control Dist. (Res., 1639 West 45th St.), Los Angeles, Calif.	Assoc. M.	April 15, 1929
KIECKERS, Ernst William. Draftsman, Stoecker Eng. Co., Webster Groves (Res., 3717 Hartford St.), St. Louis, Mo.	Jun.	July 15, 1929
KNAPP, George Selick. Chf. Engr., Div. of Water Resources of Kansas, State House, Topeka, Kans.	M.	July 15, 1929
KNAPPEN, Theodore Temple. Associate Engr., U. S. Engr. Office, Board of Trade Bldg., Cairo, Ill.	Jun. Assoc. M.	Jan. 16, 1928 June 10, 1929
KNOERLE, Joseph Karl. Asst. Engr., The J. E. Greiner Co., 1308 Lexington Bldg. (Res., 2905 North Charles St., Apartment 302), Baltimore, Md.	Assoc. M.	Jan. 14, 1929
KUCHAR, Frank Miles. Pres., Kuchar Brothers, Montvale, N. J...	Jun. Assoc. M. M.	Oct. 3, 1911 Jan. 13, 1919 July 8, 1929
LANDAUER, Leo Levy. Draftsman, City Eng. Dept., Care, City Water Dept., Dallas, Tex.	Jun.	July 15, 1929
LAZENBY, Frederic Arthur. Draftsman, British Columbia Elec. Ry. Co., Ltd., Constr. Dept., B. C. Elec. Ry. Co., Vancouver, B. C., Canada.	Jun.	June 10, 1929
LOEFFLER, Henry Stanley. Bridge Engr., G. N. Ry. (Res., 1723 La Fond St.), St. Paul, Minn.	M.	July 15, 1929
LYMAN, James Duncan Knapp. Contr. Engr. and Director, The Mt. Vernon Bridge Co. (Res., 506 East Chestnut St.), Mount Vernon, Ohio.	Assoc. M. M.	June 4, 1913 July 15, 1929
MacKRELL, Edwin Allan. Designer, Western Elec. Co., 80 John St., 14th Floor, New York, N. Y.	Assoc. M.	July 15, 1929
McCARTHY, James Anthony. 63 Dix St., Dorchester, Boston, Mass.	Jun.	Mar. 11, 1929
McNULTY, Carrell Stewart. Box 481, Springfield, N. J.	Jun.	May 13, 1929
MANSFIELD, Myron Gorton. Div. Engr., Morris Knowles, Inc. 507 Westinghouse Bldg. (Res., 7046 Penn Ave.), Pittsburgh, Pa..	Assoc. M. M.	Oct. 11, 1920 July 15, 1929
MARTIN, Christopher Carlos. County Engr., Kingman County; Res. Engr., Federal Aid Project 341 (Res., 835 North Main St.), Kingman, Kans.	Assoc. M.	July 15, 1929
MATTISON, George Carl. Hydrographic and Geodetic Engr., U. S. Coast and Geodetic Survey, Washington, D. C.	Assoc. M. M.	April 25, 1921 June 10, 1929
MAURO, Gasper. Supt. of Bldg. Constr., Wiglan Bldg. Co., 56 West 54th St., New York (Res., 617 St. Johns Pl., Brooklyn), N. Y.	Jun.	June 10, 1929
MILLER, Murray Johnson. Care, U. S. Engrs. Office, 607 Postal Telegraph Bldg., Kansas City, Mo.	Assoc. M.	June 10, 1929
MINETTI, Bernard Joseph. Steel Designer, Gibbs & Hill, New York (Res., 58 Lincoln Pl., Brooklyn), N. Y.	Jun.	July 15, 1929

MEMBERS—(*Continued*)

	Date of Membership.
NAVE, Horace Greeley. Concrete Insp., Phoenix Utility Co., Waterville, N. C.	Jun. July 15, 1929
NELSON, Elmer Andrew. Dist. Engr., National Fireproofing Co., Fulton Bldg., Pittsburgh, Pa.	Assoc. M. July 15, 1929
NICHOLS, Earl Elmore. Tooele, Utah	Jun. Mar. 11, 1929
NICHOLS, Marvin Curtis. Cons. Engr. (Hawley & Freese), 411 Capps Bldg., Fort Worth, Tex.	Jun. Nov. 25, 1919 Assoc. M. Jan. 14, 1924 M. July 15, 1929
NILES, Arthur Herbert. Cons. Engr. (The A. H. Smith & Niles Co.), 1521 Nicholas Bldg., Toledo, Ohio.	Assoc. M. June 10, 1929
NOLAN, William Anthony. Junior Engr., H. G. Balcom, 10 East 47th St. (Res., 1211 Ogden Ave.), New York, N. Y.	Jun. June 10, 1929
PHILLIPS, Edwin William. Res. Engr., Levy Court (Res., 710 West 27th St.), Wilmington, Del.	Assoc. M. July 15, 1929
POWELL, Virgil Oscar. Overseer, U. S. Engrs. M. R. C., Care, U. S. Engr. Office, Board of Trade Bldg., Cairo, Ill.	Jun. July 15, 1929
RAY, Frederick Chamberlain. Engr., Hardaway Contr. Co., Inc., Bloxham, Fla.	Jun. Dec. 15, 1924 Assoc. M. July 15, 1929
REEVES, Arthur Blaine. Supt., Goshen Irrig. Dist., Torrington, Wyo.	Assoc. M. July 15, 1929
RITNER, Thomas Herbert. Engr., C. H. Earle, Inc. (Res., 59 South Center Ave.), Rockville Center, N. Y.	Jun. May 28, 1923 Assoc. M. July 15, 1929
RUSSELL, George Raymond. Chf. Engr., Continental Oil Co., Ponca City, Okla.	Assoc. M. Oct. 21, 1924 M. July 8, 1929
SALMOND, Irving Munro. Designer and Detailer, Detroit Edison Co. (Res., 15 Waverly St., Highland Park), Detroit, Mich.	Jun. Mar. 11, 1929
SASSO, Maurice. Structural Engr., 124 West 4th St., Room 632, Los Angeles, Calif.	M. Mar. 11, 1929
SCHUTZ, Max Adolf. 62 Spadina Parkway, Pittsfield, Mass.	Assoc. M. June 10, 1929
SCOTT, Walter Bramah. 64 Mountview Ave., Toronto, Ont., Canada.	Assoc. M. June 10, 1929
SHEIRY, Edward Slater. 401 High St., Chevy Chase, D. C.	Assoc. M. July 15, 1929
SHIFRIN, Hymen. Asst. Chf. Engr., Div. of Sewers and Paving Dept. of the Pres., Board of Public Service (Res., 5941 McPherson Ave.), St. Louis, Mo.	Assoc. M. Aug. 4, 1924 M. July 15, 1929
SKARDON, Kenneth Bruner. Designing Engr., The Wendell P. Brown Co., 750 Prospect Ave., Cleveland (Res., Aurora) Ohio	Assoc. M. Mar. 15, 1926 M. July 8, 1929
SKINNER, Guy Burdette. Asst. Engr., Constr. Div., Bureau of Lighthouses, Dept. of Commerce (Res., 1448 Park Rd., N. W.), Washington, D. C.	M. June 10, 1929
SNODERLY, Murphy Ulysess. Res. Engr., Klyce & Harrub, 705 Fourth and First National Bank Bldg., Nashville, Tenn.	Assoc. M. July 15, 1929
SNYDER, Baird, 3d. Pres., Snyder Eng. Co., Lincoln, N. J.	Jun. Oct. 21, 1924 Assoc. M. June 10, 1929
SOWERS, George Bloomer. Deputy Commr., Div. of Eng. and Constr., City of Cleveland, 618 City Hall, Cleveland, Ohio.	Assoc. M. June 7, 1926 M. July 8, 1929
STEMWELL, William Ignatius. Asst. Bldg. Engr., Commonwealth Edison Co., 72 West Adams St., Chicago (Res., 1111 Holley Court, Oak Park), Ill.	Jun. Feb. 25, 1924 Assoc. M. Mar. 11, 1929
STOECKER, William. Cons. Engr., 650 East Big Bend Boulevard, Webster Groves, St. Louis, Mo.	Assoc. M. July 11, 1921 M. July 15, 1929
STORY, John Wilson. 1322 East McMillan, Cincinnati, Ohio.	Jun. July 15, 1929
STURGEON, Ralph Andrew. Asst. Dist. Engr., State Highway Dept. (Res., 324 West Ridge Ave.), Harrison, Ark.	Assoc. M. June 10, 1929
TELFORD, Robert Lee, Jr. Richmond, Ky.	Assoc. M. July 15, 1929
THOMPSON, Albert Nesmith. Asst. Engr., Knoxville Power Co., Box 5, Calderwood, Tenn.	Assoc. M. Jan. 14, 1929
THORNBURG, Lewis. Lt.-Commander, C. E. C., U. S. N.; Asst. Public Works Officer, Navy Yard, Mare Island, Calif.	Assoc. M. Dec. 15, 1924 M. July 8, 1929
TOSI, Joseph Andrew. Chf. Engr., E. J. Cross Co., 82 Foster St. (Res., 173 King Philip Rd.), Worcester, Mass.	Assoc. M. July 6, 1920 M. July 15, 1929
UNDERWOOD, Paul Halladay. Prof., Topographic and Geodetic Eng., Cornell Univ. (Res., 960 East State St.), Ithaca, N. Y.	M. July 15, 1929
UNGER, William Louis. Asst. Engr., Engr. of Structures Office, N. Y. C. R. R., 466 Lexington Ave., New York (Res., 8526 One hundred and forty-eighth St., Jamaica), N. Y.	Jun. Oct. 7, 1914 Assoc. M. Nov. 25, 1919 M. July 8, 1929
VELLEMAN, Gerard. Plant Mech. Engr., Toledo Edison Co. (Res., 3863 Almeda Drive), Toledo, Ohio.	Assoc. M. June 10, 1929
VERDUIN, Abraham. Asst. Engr., Public Service Production Co., Newark (Res., 96 Marion St., Paterson), N. J.	Assoc. M. July 15, 1929
VOGHT, Walter Ryan. With John A. Roebling's Sons Co. (Res., 305 Cuyler Ave.), Trenton, N. J.	Jun. July 15, 1929
WALDREP, Judge Scott. Res. Engr., Ira G. Hedrick, Inc., Fulton, Ark.	Assoc. M. July 15, 1929
WARDLAW, Joseph George, Jr. Asst. to Constr. Engr., Saluda River Hydro-Elec. Development, Box 92, Columbia, S. C.	Assoc. M. July 15, 1929
WENTWORTH, Winslow Clarence. Chf. of Party, Turners Falls Power & Elec. Co., 20 Cortey St., Westfield, Mass.	Jun. Mar. 11, 1929

MEMBERS—(*Continued*)		Date of Membership.
WESTON, Harry Bearne. Constr. Supt., Henry Steers, Inc., New York, N. Y. (Res., 500 Garfield Ave., Jersey City, N. J.)	Assoc. M.	June 10, 1929
WHEATLEY, Walter Hannum. Commr. of Public Works, City of Okmulgee; Box 392, Okmulgee, Okla.	Assoc. M.	July 15, 1929
WHEELER, Jerrold Ellsworth. 109 Cleveland Ave., Avalon, Pittsburgh, Pa.	Jun. Assoc. M.	July 9, 1923 Mar. 11, 1929
WHITTLE, George Dilley. Highway Bridge Engr., U. S. Bureau of Public Roads, 807 Sheldon Bldg., San Francisco, Calif.	M.	Mar. 11, 1929
WILLIAMS, Richard Giles. Supt. of Aid Projects, State Highway Dept., Austin, Tex.	Assoc. M. M.	Nov. 25, 1919 July 8, 1929
WILSON, Winfred Ernest. Structural Engr., United Pacific Securities Corporation (Res., 2442 Marvin Ave.), Los Angeles, Calif.	Assoc. M.	June 10, 1929
WINEGARDNER, Ralph George. Engr. with City of Los Angeles, City Hall (Res., 7705 Santa Monica Boulevard), Los Angeles, Calif.	Assoc. M.	Mar. 11, 1929
WOLF, Richard Jarrett. Structural Squad Leader, Philadelphia Rapid Transit Co., Mitten Bldg. (Res., 5956 North Lawrence St.), Philadelphia, Pa.	Jun. Assoc. M.	Feb. 25, 1924 June 10, 1929
WOLFE, Thomas Francis. Research Engr., Cast Iron Pipe Research Assoc., 122 South Michigan Ave., Chicago, Ill.	Assoc. M. M.	Sept. 10, 1923 July 15, 1929
WOULFE FLANAGAN, John Henry. Res. Engr., Southend-on-Sea New Sewerage, Bournes Green, Southend-on-Sea, Essex, England.	Assoc. M.	Mar. 11, 1929
YERINGTON, Myles. Structural Designer, City of Tacoma (Res., 115 South G St.), Tacoma, Wash.	Assoc. M.	July 15, 1929
ZISLIN, Louis. Chf. Engr., Wm. Linker Co., 735 Cherry St. (Res., 5818 Rodman St.), Philadelphia, Pa.	M.	July 15, 1929

Reinstatements

ASSOCIATE MEMBERS	Date of Reinstatement.
GROSS, DeWitt Clinton Gross	July 2, 1929

Resignations

MEMBERS	Date of Resignation.
MOORE, Clifford Bennett	July 26, 1929
ASSOCIATE MEMBERS	
AICHEL, Walter August	July 26, 1929
RINEHART, Charles Ramsay	July 8, 1929
JUNIORS	
MARKEL, Eldon Hugh	July 26, 1929

Deaths

EDDY, Adolphus James. Elected Junior, December 6, 1910; Associate Member, July 6, 1920; died June 28, 1929.

HUMPHREYS, Charles Raymond. Elected Associate Member, June 3, 1915; Member, January 16, 1928; died June 1, 1929.

McDONALD, Charles Neil. Elected Member, January 17, 1927; died July 5, 1929.

McKENZIE, Thomas. Elected Junior, May 2, 1893; Associate Member, November 6, 1895; died July 25, 1929.

ROACH, Harry Fay. Elected Member, January 19, 1925; died July 28, 1929.

RODD, Thomas. Elected Member, June 5, 1878; died August 3, 1929.

SPATHELF, David Edward, Jr. Elected Junior, October 1, 1928; died March 28, 1929.

Total Membership of the Society, August 6, 1929

Members	**5 651**	
Associate Members	**6 056**	
Corporate Members		**11 707**
Honorary Members		**14**
Juniors		**2 148**
Affiliates		**145**
Fellows		**7**
Total		**14 021**